Industrial QUALITY CONTROL

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In This Issue

Professionalism and the Quality Control Engineer

SQC in the Soviet Union

Automatic Filling Control

Sampling Is Used to Determine Inventory Valuation

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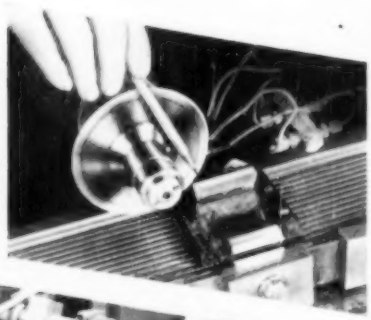

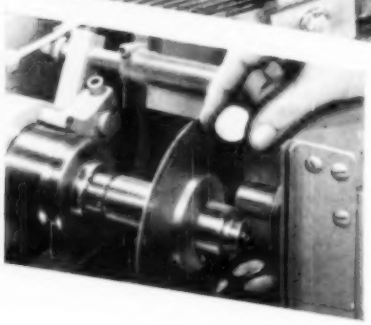

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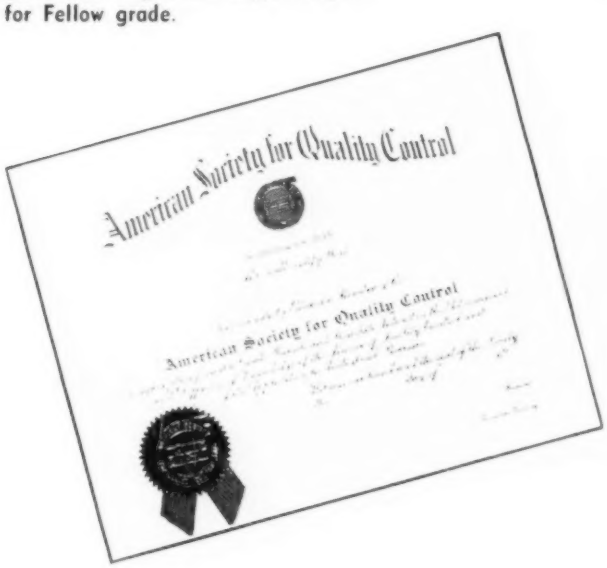

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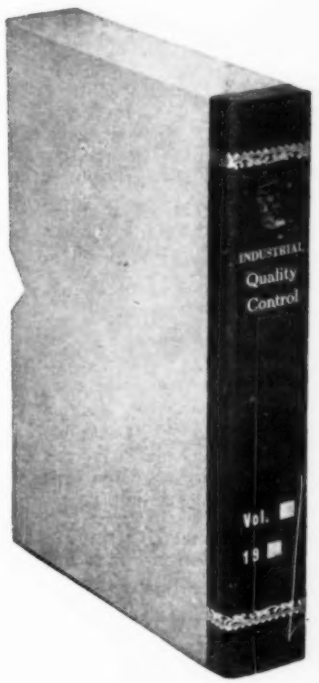

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Contents

ARTICLES

The Professional Work of the Quality Control Engineer
Dr. A. V. Feigenbaum 5
This report of the Committee on Professionalism presents an outline of the basic work elements of the quality control engineer.

Statistical Method and the Quality Problem in the Soviet Union
Joseph A. Gwyer 9
A timely and interesting discussion on the historical developments and present status of quality control in the U. S. S. R.

Automatic Statistical Filling Control—A Case History
W. C. Frey and W. M. Spencer 13
This article discusses the problem of a production line method for controlling the fill count of a bottle of pills by means of weight measurement—also the methods of controlling raw materials and pressing methods so that the variability in total weight wouldn't be greater than the weight of a single pill.

Inventory Valuation by Sampling
W. E. Courtright and A. A. Procassini 16
The authors present a time saving and hence economical statistical technique to replace conventional inventory valuation methods.

DEPARTMENTS

From the President's Desk, *Section Management* 4
From the Scrap Box
A Team Approach to Process Development, Edward J. Brazill 21
What Constitutes the Total Price of a Purchase, R. Calvert Haws . . . 24
Twelfth Annual Convention 22-23
What's New? 27
Supervisor's Circle
Special Inspection Tests Determine the Spring-making Properties of Pre-tempered Steel Strip, William R. Johnson 31
Section Briefs 33
Section Calendar 34
Clinics, Conferences, and Courses 39-40
Product Education Service 40
Positions Available 26, 30, 39, 40
Consulting Services 40

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From the President's Desk

Section Management

Section management is an elusive thing to describe because good section management is made up from a number of activities. Essentially it is a team function, but strong direction is needed. A year of weak leadership can set a section back several years.

Generally good section management results in a program that attracts attendance at meetings and results in a steady growth of the section in the two communities—both the local area and the community of sections that make up the American Society for Quality Control. Hence, planning and continuity are essential. The well managed section meets most, but probably not all of the following measurements to a reasonable degree:

1. A well planned yearly program, with planning started by May, and firmed by August of each year. The subjects and the speakers are diversified to meet all interests. To do this, new officers should be elected early, before the summer slump prevents active efforts and cooperation.

2. An active Membership Committee, that will attract new members, and will keep in contact with old members, particularly those who might be showing disinterest and whose real desires need to be met in planning the program.

3. A good publicity committee which will enhance the standing of the section in the local community and support the industrial or other relationships of members, and which will be active with news in *Industrial Quality Control* and with local newsletters and other intra-section activity beyond the mere monthly notices of meetings. Attendance measures the success of this program.

4. A well planned educational program and the development of local talent as speakers and authors of technical papers of national interest. Many sections undertake special community projects. These include the establishment of sub-sections and student chapters wherever possible.

5. Special meetings are arranged, including plant visits, joint ASQC meetings, and joint meetings with other societies. A section that is "going places" takes an active part in the local technical organizations, and is known for more than just the statistics of quality control.

These properties as above listed are general and are not the only ones of importance. They will vary from section to section. To promote good management the Society has established the Saddoris Competition for Section Management, which endeavors to make a balanced measure of the many aspects of good section management. This results in suitable awards each year to the best managed sections and provides an incentive for better operation of our Society.

Sincerely,

Leon Bass

The Professional Work of the Quality Control Engineer

DR. A. V. FEIGENBAUM

General Electric Company, New York, N.Y.

Background Philosophy

We quality control men today face the most crucial problem—and, at the same time, the most promising opportunity—of our industrial careers.

Our *problem* is caused by the explosive evolution of quality control in the United States. Quality control is rapidly becoming an activity whose business-wide scope requires broad-gaged technical programs which far outstrip the statistical concepts and the inspection techniques of our early beginnings.

Our *opportunity* is to develop the kinds of technical programs which can really come to grips with industrial management's increasing demand for improved product quality and lower costs. In the process, we can hammer out a modern engineering profession which will, for the first time, give first-team recognition to the quality control man. And, in turn, our American Society for Quality Control can gradually take its place among the major professional engineering societies in America.

This "*Challenge of Total Quality Control*" was discussed in the May, 1957 issue of *INDUSTRIAL QUALITY CONTROL*. The article has been the subject of much comment and discussion.

Editorial Note

The document presented here represents the first phase of a long-range program proposed by the Special Committee on Professionalism. This committee was appointed to study the problem of developing a course of action for ASQC aimed at securing recognized professional engineering status for the quality control engineer.

Obviously, the first step in such an assignment consists of spelling out the basic work elements of the professional quality control engineer. The committee submits that a man trained and competent to discharge the responsibilities specified and implied by the basic work elements herein outlined meets standards of professional competence sufficiently unique in character, calibre, and importance to modern industrial activity to merit recognition and designation as a professional quality control engineer.

M.E.W.

Among the pertinent actions taken has been the appointment, by President Leon Bass and Past President Dale Lobsinger, of a committee to consider the professionalism needs of Quality Control Engineering. The distinguished Quality Control men who accepted appointment to this committee have been Robert M. Berg, Edwin C. Harrington, Jr., David A. Hill, Paul A. Robert, Robert Schin, Gordon Thompson, Wade R. Weaver, and Professor Mason E. Wescott. The author has acted as committee chairman.

The committee faced squarely the current facts-of-life about quality control professionalism.

Our activity is *not* yet recognized as professional in many areas of industry, nor by some other professional engineering societies, nor certainly by most state professional engineering licensing boards. Membership and fellowship in ASQC do *not* yet quite convey to a man the same esteem in the eyes of his company that such status may give when granted by the longer-established engineering societies.

There is only one way in which we can achieve for quality control engineering the professional recognition we seek: We must earn it and we can earn it only by our accomplishments both in technical contributions to industry, and by acceptance and discharge of the national, state, and community responsibilities that are inherent in the obligations of any profession.

The first requirement for earning this recognition is the development of a common understanding among we quality control men ourselves. We must be together on the kind of work we mean when we talk about quality control. Only with such common understanding can we both unify our own programs leading to professionalism, and also communicate the facts about quality control engineering work to those who can help us bring it into being.

Such common understanding must, of course, be extremely flexible so as to take account of the many variations in quality control requirements that exist among different industries. It must recognize the rapid changes in these requirements; just as today's quality control differs from yesterday's, so will there be many

changes in the quality control work of tomorrow. But it should formalize the technical hard core that does exist in quality control—the similar types of work which have always made it possible for quality control engineers to talk with each other and learn from each other—no matter how different their companies or their products.

In the past, we have too often displayed a bits and pieces approach to quality control, and have tended to gallop simultaneously in several directions toward those techniques that were hotly popular at the moment. Some managers and some engineers in other technical fields have, consequently, regarded us as pinch-hitters for special situations. The have considered our work no more professional than the work of factory trouble-shooters or expediters.

We must, therefore, establish what really are the specific engineering contributions we make to industry that warrant professional recognition. Are they in better product design? In better in-process control? In better testing practices? In improved inspection technique? In pre-production pilot run procedures? In substance, we must establish the basic elements of technical work in quality control that we consider to be professional.

Such a documentation of elements of the professional work of the quality control engineer is included later in this article. Its development has been the first task of the ASQC Professionalism Committee. Grateful acknowledgment for help in its preparation is extended to Wyatt H. Lewis and to William J. Masser and to several of the experienced quality control engineers who are their associates.

These work elements are offered as a common basis for approaching the activity of the quality control engineer in Total Quality Control. They are presented in all humility by the Professionalism Committee, in recognition that the details of quality work in all aspects of American industry can never be fully covered in any single document.

The work elements are offered to quality control men for their discussion and comment, as the basis for the progressive improvement of the document. In particular, many ASQC sections may wish to make review of these work elements the topic of a meeting or the objective of a special project. Some of these sections might wish to use these elements as the basis for their meeting programming and their educational planning.

There are several points that should be made concerning this document.

1. Since quality control language sometimes differs from company to company, there are not yet any common set of terms to describe the activity. This document has used the terms in most general useage; but some quality control men or ASQC sections may want to substitute some of their own terms for the language used here.

2. The totality of the work elements is not, of course, intended to describe the work of any single quality control engineer nor the work of any particular quality control organization. A quality control engineer may specialize in a few elements only—or perhaps in one element—and still be doing legitimately professional work. The elements as presented are intended to cover the entire range of technical work that may be performed in total quality control. Particular circumstances in a particular company may require that only a portion of these elements be pursued to achieve total quality control results. In an engineering company that does little manufacturing, for example, work done may be almost exclusively in the New Design area.

3. Some of the work elements are much more technical than others. A few of the elements have relatively little technical content, and quality control men who use this document may wish to eliminate them from professional consideration.
They are included in this document simply in recognition that, in the present state of the quality control art, some of this work has to be done. As total quality control progresses and becomes more technical, later revisions of this document can eliminate the work elements which no longer qualify.

4. These work elements do not indicate any intention to set unrealistically rigid criteria for professional status such as graduation from specific technical schools. The criteria, instead, are simply the demonstrated ability to accomplish these quality control engineering work elements—independent of the educational sources from which these abilities were derived.

The professional standards provided by these work elements will form the foundation on which the Professionalism Committee will perform the five additional tasks it is charged with discharging before disbanding:

1. The integration of these professional standards with employers of quality control engineers.

2. The development of educational and self-improvement programs through which local sections may assist members in increasing their membership grade through "moving up the professional chairs."

3. Working with colleges and universities to encourage the introduction of quality control engineering as a particular area of technical education.

4. Working with state and national agencies so as to encourage the recognition of quality control engineering as an area suitable for professional engineering licensing.

5. The outlining of areas of national, state, and local contribution and service by the quality control engineer, in recognition that such public service is an inherent requirement for professionalism.

The ultimate objective, of course, is acceptance of quality control engineering as one of the major new sectors of the American engineering profession. And, it is also desired that the professional quality control engineer be recognized as an essential member of the management team of any business that wants to grow, to be profitable, and to be genuinely healthy.

The Basic Elements of Work of Quality Control Engineering

This report includes a documentation of the first phase of the professionalism program. It considers the quality control engineer as "the professional man dedicated to the improvement and maintenance of product quality which will fully satisfy American customers at optimum costs of quality." To accomplish this, quality control engineering must carry on technological activities through the entire operational cycle of the enterprise: from marketing and product design through receipt of the product by a satisfied customer.

Work in this regard may be considered in four major areas:

I. New design

II. Incoming material

III. Process and product control

IV. Special process studies

The chart (see Fig. 1, page 8) depicts the relationship of these areas to the total operational cycle. The work elements of the quality control engineer in each of these areas are listed on the following pages.

I. New Design

1. Investigate and prepare long-range quality control plans based upon the forecasted needs of the business.
2. Keep informed on quality measurement developments, applications and technologies and recommend their use where applicable.
3. Keep informed on new statistical techniques and adapt these to assist in the analysis of new design.
4. Establish realistic product quality objectives. Work with marketing and design engineers in establishing quality requirements on the basis of the customers' need, the function of the products, their reliability, salability and value.
5. Review new and revised designs. Recommend improvements to design engineering that increase product uniformity and quality satisfaction. Recommend improvements to simplify control of manufacturing processes and quality evaluation, thereby reducing costs.
6. Review performance, environmental, life and shipping test results on a product or device to know that design requirements have been met.
7. Determine quality capability required of new manufacturing machinery and equipment.
8. Establish quality procedures for the manufacturing operation, and consolidate these procedures as a complete quality system for controlling product and process quality. Planning should include: product quality characteristics and levels, inspection and test procedures, operator quality checks, statistical quality control techniques, information feedback, quality ratings, required inspection and test equipment, defective materials disposition procedures and any other pertinent data. On the basis of such planning, provide appropriate manufacturing components with cost estimates and time schedules pertaining to the quality system.
9. Assist in establishing quality standards. Work with marketing and design engineering to establish, define, and provide quality standards on such items as appearance, surface roughness, color, noise vibrations, etc.
10. Plan controls for incoming material quality. Designate incoming material quality characteristics to be measured and their respective quality levels, specify inspection and test equipment, and sampling plans. Establish procedures for controlling the quality of purchased equipment, tools, ties, and fixtures.
11. Determine capabilities and/or measurement error of measuring devices.

II. Incoming Material

1. Correlate quality control procedures and measurements with suppliers.
2. Delineate to suppliers (through Purchasing) quality requirements of purchased materials.
3. Evaluate quality of purchased materials against specification and in accordance with established procedures.
4. Establish records of purchased material quality by part and supplier and provide feedback to vendor.
5. Make proper disposition of purchased materials that fail to meet quality requirements.
6. Work with suppliers, through Purchasing, to establish quality certification plans, whereby the supplier furnishes his inspection results along with shipments, thereby permitting an audit of input quality on a reduced inspection basis.
7. Assist suppliers as required to assure their scheduled quality output.
8. Provide Purchasing with a vendor rating based on quality performance.

III. Process and Product Control

1. Determine capability of manufacturing processes to meet quality requirements. Recommend adjustments for process conditions to manufacturing engineering, and/or adjustments of product specifications to design engineering, to create an economic and compatible relationship between process and product. Establish procedures to assure maintenance of specified process conditions which affect quality and cost of output.
2. Evaluate quality performance of new manufacturing machinery and equipment.
3. Audit the effectiveness of the in-process quality procedures, adherence to procedures, process stability, correlation between process conditions and product quality.
4. Audit the product for conformance to quality specifications and to provide a measure of the effectiveness of in process quality control systems.

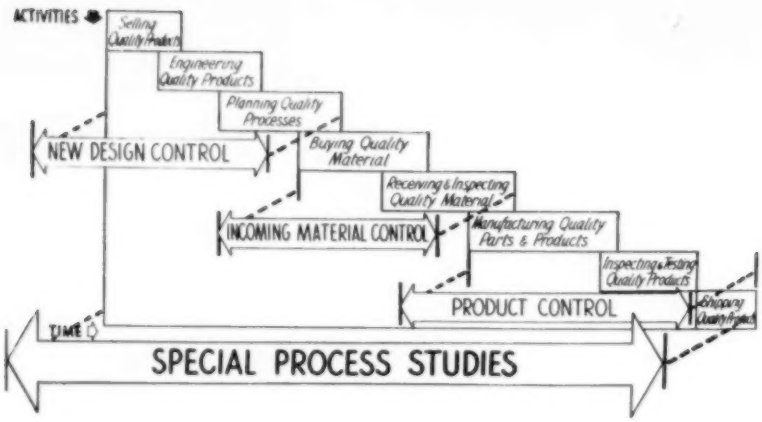

Figure 1—Quality Control Activities During the Manufacturing Cycle*

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5. Establish process and set-up measurement service., Provide operators with quality measuring means.

6. Audit packaging, shipping materials and loadings for conformance to specifications and effectiveness of these specifications.

7. Provide special measurement service. This includes measurements on samples, prototypes, pilot runs, tools, tooling, process and machine capabilities.

8. Establish and interpret all quality measurement records and furnish data to other functions. Initiate corrective action.

9. Provide for the prompt disposition of rejected material and product. Assure disposition that meets requirements of quality standards and production schedules. Assign for the purpose of corrective action responsibility for losses incurred by rejection. Assure that corrective action has been taken.

10. Maintain accurate and usable quality standards by auditing for accuracy and applicability drawings, specifications, standard shop practice and tolerance specifications and other related standards. Audit visual standards and masters for quality, accuracy, and usability. Feed back to appropriate units all information for corrective action and assure that such action is taken. Establish interim quality standards as needed. Interpret all standards to shop operations.

11. Establish a control and calibration activity for production devices (jigs, fixtures, tools, dies, welding, heat treating, soldering, annealing, casting, ovens, etc.) to insure original adequacy and maintenance to produce repeatable quality.

12. Provide and maintain safe working conditions, quality control measuring equipment, and procedures. Audit these to assure safety. Maintain safety awareness and mindedness throughout the organization.

13. Analyze customer complaints. Feedback analysis and identify causes to appropriate organizations. Instigate corrective action. Follow and report progress to appropriate management.

14. Examine goods returned by customers making necessary measurements to determine responsibility and facts. Audit repairs and final inspection before return to customer.

15. Measure final product characteristics to assure that product has required conformance and performance to give customer satisfaction.

16. Make data from such tests available to other functions.

17. Provide necessary data for customer quality certification programs. Advise on guarantees the product can support.

18. Develop and implement specific methods and procedures for data collection, tabulation, analysis and dissemination. Include utilization of automatic data processing where feasible.

19. Develop and implement effective forms and reports to establish responsibility, specify corrective action required and provide a basis for comparison to measure performance.

20. Analyze and feedback quality information from incoming material, in-process and final inspection reports; incoming material, in-process, and final quality audits; record charts from automatic process controllers and quality level indicating devices; chemical, metallurgical and physical laboratory tests; customer complaints and field reports. Analysis to be sufficiently factual and complete to serve as a basis for corrective action.

21. Analyze costs of achieving and maintaining product quality to apportion expenditure of quality dollars in the areas of prevention, appraisal and failure, for overall reduction in quality costs. Measure performance by means of comparison bases.

IV. Special Studies and Activities

1. Develop a system for, and assist Purchasing in, making facilities checks and capability studies on suppliers.

2. Develop new techniques and approaches for the analysis of quality problems.

3. Conduct quality control training programs for personnel to provide understanding and use of quality control techniques. Insure quality-ability of personnel on new assignments and assist in instilling quality mindedness throughout the organization.

4. Collaborate with industrial and professional organizations to promote the objectives of quality control.

Statistical Method and the Quality Problem in the Soviet Union

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Introduction

As a result of recent scientific developments in the U.S.S.R., the interest of the American people has been reawakened in technological and industrial progress overseas. Like other engineers and scientists, quality control engineers have also developed a new interest in what foreign scientists, engineers and mathematicians are accomplishing. This interest, of course, focuses particularly on Russia.

The following survey was written to give quality control engineers a bird's-eye view of the progress of statistical quality control in the U.S.S.R., based on a review of unclassified literature. This literature is available to anyone who is willing to consult Russian technical periodicals. It is not the purpose of this survey to measure in depth the extent of the U.S.S.R.'s interest in quality control. A real measure of Russian progress would require a considerably more penetrating search of the literature than this survey represents. The author's intent is simply to give the reader a general insight into what is developing in Russia and thus to stimulate interest in a subject of far-reaching importance.

Editorial Note

Industrial Quality Control feels privileged to have the opportunity to present this timely and interesting article. It contains numerous pointed morals that American industry may well take to heart in asking itself to what extent it is *really* capitalizing on the full potential available to it through the sincere adoption as a recognized arm of sound management of a broad, integrated, active program of modern, scientific quality control using statistical methods.

M. E. W.

General Comment

It would be erroneous to underestimate the importance which the Soviet industrial planners have assigned to statistical methods of controlling product quality during manufacture. The evidence so far available shows that statistical controls are being employed by a large segment of the U.S.S.R. industry on a constantly increasing scale.[1]

Promising gains were attained since 1950 by the Soviet industrial establishments employing quality control techniques. Plants which introduced these "modern" techniques reported substantial increases in the productivity of workers, significant reduction of defectives, and great economy in use of raw materials.

As of 1953, quality control was employed by numerous machine-building, metallurgical, petroleum-processing, leather-working, and ball-bearing plants. Among these were the "Frezer" plant specializing in production of machine tools, "Kalibr" plant specializing in production of instruments, the SAM Moscow plant producing calculating and computing equipment, the Sverdlovsk ball-bearing plant and most of the other ball-bearing plants of the U.S.S.R., the "Stalin" automobile plant (ZIS), the Leningrad plant "Progress," most plants of the Ministry for Aviation Industry, and a considerable number of plants of the Ministry for Electrical Machine Building.

Since exact information on the number of industrial establishments and the extent of employment within each plant is not available, the examples cited above are not necessarily representative of all of the U.S.S.R. industry. According to a somewhat excessive claim by Novikov[2], the industrial establishments employing quality control techniques have achieved remarkable successes. As an example, the "Frezer" plant in Moscow reduced in 1951 its production losses by 40 percent. In individual operations, the number of defective piece-parts was practically eliminated, the productivity of workers and machine tools increased by more than 30 percent, and the cost of production was reduced by 18 percent.

Similar achievements were reported for the Sverdlovsk ball-bearing plant which introduced quality control in the Spring of 1951.[3] The above plant, following the lead of other ball-bearing plants of the U.S.S.R., introduced the quality control technique of "averages and ranges" for analysis of the stability of its production processes, and the technique of "individual values" for the control of production and curtailment of scrap.

Definitions

Product quality itself in its broad meaning is defined by the Soviets as the ". . . ability of production to fulfill adequately its assignment and to satisfy the needs and desires of the majority of consumers, and desires dic-

(1) Novikov, A. S., *Statisticheskie metody kontrolia kachestva promyshlennoi produktsii*, Moscow, Znanie, 1953, p. 3

(2) *Ibid*

(3) Kovalev, A. M., *Opyt vnedreniia statisticheskogo kontrolia na zavode*, Sverdlovsk, Mashgiz, 1952, p. 13

tated by the interests of the entire society."[1] In a more narrow sense, the term "product quality" denotes the conformity to established engineering specifications or standards.

The modern term "quality control," commonly used in the United States, denoting that phase of the control of quality which uses mathematical and statistical methods as scientific aids toward securing more accurate determinations of quality conditions and consequently better quality has been sanctioned by the U.S.S.R. and it is used throughout her industry.[2]

Historical Survey

The term "quality control" up until 1946 was applied only in the acceptance of finished products. The "control" consisted largely of checking to determine whether finished products conformed to predetermined standards and to find the basic contributing causes of defectives when too large a number accrued. Under such a narrow concept of "quality control," the then most widely used method of control was the technique of "final continuous rejection of defectives."[3]

Using the above technique, the quality of each manufactured item was evaluated only on the basis of its suitability or unsuitability. The inspector was not interested in the dimension within the tolerance zone when the item was found to be suitable, or in the deviation from the tolerance limits when the item was defective. The tendency to evaluate the quality of each manufactured item resulted in the application of a "continuous" (sploshnoi) 100 percent inspection. Sampling inspection was considered by the Soviets as not fully adequate and was seldom used.

The reliance on external controls, consisting of detailed inspections of each outgoing product, did not eliminate the appearance of defectives in the hands of consumers. In order to step up the effectiveness of inspection methods, the Presidium of the Supreme Soviet of the U.S.S.R. issued on 10 June 1940, a decree fixing the ". . . responsibility for output of defective or unfinished products and for nonobservance of obligatory standards by industrial establishments." This decree issued on the eve of the German-Russian war stipulated that the ". . . output of defective or unfinished industrial goods and output of goods not conforming to obligatory standards is considered as an anti-state crime equivalent to sabotage."

The wartime and postwar attack on waste and the drive to reduce the amount of scrap resulted in the following measures:[4]

1. Introduction of analysis of defects by type, cause, and source.
2. Daily sampling for defectives.
3. Organization of a fully qualified apparatus for technical control.
4. Organization of an accounting system that would consider the complaints from consumers.
5. Encouragement of competition for better quality between various shops within a plant and between plants of the industry.
6. Introduction of "Quality Control Techniques."

[1] Gostev, V. I., *Puti uluchsheniia kachestva produktsii*, Moscow, Moskovskii Rabochii, 1941, p. 7

[2] Borodachev, N. A., *Analiz kachestva i tochnosti proizvodstva*, Moscow, Mashgiz, 1946, p. 4

[3] Braginskii, L. L., *Operativnyi statisticheskii kontrol' kachestva v mashinostroenii po metodu individual'nykh znachenii*, Moscow, Mashgiz, 1951, p. 7 L. L.

[4] Gostev, *op. cit.*, p. 29-30

The merits of the latter measure were readily recognized by the Committee on Measures and Measuring Instruments of the Council of Ministers of the U.S.S.R. This Committee being fully aware that quality control leads to a better quality product through reduction of scrap and through minimization of efforts wasted in producing defective goods, as proven by the experience of United States and British industries, requested one of its members to prepare a survey of the quality control practices abroad. The task of preparing such a survey was assigned to N. S. Acherkan who in 1946 published his findings in a study titled *Statisticheskie metody kontrolia promyshlennoi produktsii; osnovy teorii i praktika primeneniia v zarubezhnoi promyshlennosti* (Statistical Methods of Control of Industrial Production; Theoretical Basis and Practical Application in Foreign Industry).

This 136-page study[5] was written with two basic objectives: (1) to convey to Soviet technicians specializing in quality control the achievements in this field attained abroad, and (2) to acquaint the engineer working in a plant with methods of quality control which are not limited to final external inspection of outgoing products.

N. S. Acherkan found that in the United States the statistical quality control methods were widely employed in mass-production processes and experience gathered up until 1946 indicated their effectiveness and economic expediency.

Since the U.S.S.R. industry in most of its branches was also characterized by large-scale mass-production processes, the statistical methods of quality control became since 1946 the "order of the day." In reference to theoretical vs. practical achievements in this field by Soviet engineers and mathematical statisticians, N. S. Acherkan[6] had this to say:

> ". . . it would be proper to indicate that the practical development of statistical methods of quality control of manufacturing process and their introduction abroad (especially in the United States and England) is well ahead of that of the U.S.S.R. But in the field of establishing scientific basis for quality control techniques which would permit the exposure of the character of other than "chance" causes through statistical analysis of quality characteristics of data, the U.S.S.R. is ahead of other countries."

Among studies of a theoretical nature that are supposedly ahead of the American and British theoretical thought is one by N. A. Borodachev,[7] titled *Analiz kachestva i tochnosti proizvodstva* (Analysis of Quality and Precision of Production), in which the author devotes himself to the solution of the problem of *objective evaluation of the quality of the engineering process* through the use of mathematico-statistical principles applied to a systematic study and analysis of frequency distribution curves of production errors.

According to Borodachev, such an approach permits, in the first place, a more accurate measure of the precision of equipment than the existing tables of "average economic accuracy." It also permits a precise determination of the frequency distribution of variables corresponding to this or that engineering process. Finally, this approach appears to provide the means for comparing actual distribution curves with those of a theo-

[5] Acherkan, N. S., *Statisticheskie metody kontrolia promyshlennoi produktsii; osnovy teorii i praktika primeneniia v zarubezhnoi promyshlennosti*, Moscow, Mashgiz, 1946

[6] Acherkan, *op. cit.*, p. 8

[7] Borodachev, *op. cit.*, p. 4-5

retical nature corresponding to the employed process in order to determine if there is an abnormality in the production process and if so, to establish specifically in what this abnormality consists.

Despite his claim to originality, Borodachev[11] admits that a practical introduction of this method is facilitated by the fact that during World War II, quality control methods employed in the United States and England were based in essence on the same thesis of the probability theory and mathematical statistics, using the same mathematical rationale.

The Nature and Importance of Quality Control in Production

The period between the publication of Borodachev's study and the early months of 1950 can be characterized as the period of experimentation with quality control techniques both on a theoretical and a practical basis. During that period a new meaning was given to the term "quality control."

This new scope of meaning not only broadened the concept of quality control but also assigned to it managerial functions, thus making it a key factor in industry rather than the mere operational element of controlling the quality of finished products either by 100 percent or sampling inspection.

The basic trends of statistical studies of precision in technological processes were briefly outlined by N. G. Bruevich in his lecture read before the March 1956 Conference on Basic Problems of Precision in Machine Building, organized by the Commission for Machine-Building Technology, Machine Building Institute, U.S.S.R. Academy of Sciences.[12] Since N. G. Bruevich is considered as one of the leading Soviet authorities in the field of precision, parts of his lecture dealing with statistical studies of precision are partially translated. The following excerpts might be of interest to American quality control engineers, since they do point out the conflict of interests between the scientific group leaning heavily on theoretical concepts and the group adhering to the more analytical and "practical" approaches to the problem. According to Bruevich . . .

> ". . . statistical studies of precision carried out (by Soviet scientists) prior to the outbreak of World War II dealt primarily with quantitative characteristics and frequency distribution of variables under various conditions of production. These studies amassed a great volume of material on frequency distribution of variables; tables were prepared combining mathematical expectancy and frequency distribution of variables with tolerance zones through laws of distribution. During the past ten years studies were conducted to determine the changes in frequency distribution laws resulting from factors such as heating, dulling of cutting edges, replacement of cutting edges, rebuilding of machine tools, etc.
>
> During the 1950-51 period of discussions on the subject of precision of machinery, a crisis arose on the subject of statistical studies of precision. This crisis was caused by the fact that during the discussion opinions were expressed against the theoretical probability study concept of production of defects; the latter was contrasted with an analytical study concept of production defects. Individuals voicing these opinions asserted furthermore that in the precision of mechanisms and technological processes there are no "chance" phenomena and no "chance" variations. Many (researchers) began to shun studies of "chance" phenomena in the technology of machine building. Not everybody understood the great informing role of statistics and the theory of probability.
>
> The resulting sad state of affairs held back the statistical study of defects in the technology of machine building: the defects were not judged as by chance phenomena; some researchers remembered the previously suggested term of "functionally unexplainable variables" and considered that these are not a usual thing; some stipulated that (as of 1951) there was no adequate mathematical apparatus for studying these variables. As a matter of fact the functionally unexplainable variables appear to be random phenomena and there is a mathematical apparatus known as the theory of by chance processes.
>
> Recently, a marked improvement was observed in the application of statistical methods to studies of precision of technological processes . . ."

Resolutions of the XIX Congress of the Communist Party dealing with the Fifth Five-Year Plan for the development of the U.S.S.R. economy (1951-55), indicate that a great stress was placed on the necessity for increased quality of products manufactured by all branches of the industry. The resolutions envisaged a plan that would ". . . assure the fulfillment of requirements outlined by the State All-Union Standards; would provide the State with analyses of product quality and production processes in order to detect and correct the shortcomings; and would eliminate and control the appearance of defective products."[13]

However, it was recognized even then that strict technical controls alone do not necessarily guarantee proper control of production processes and not always satisfy needs created by modern mechanized establishments. The causes of the above were attributed to (1) absence of a well worked-out methodology of control, (2) underestimation of the value of quality control techniques in the production processes, and (3) inadequate mechanization of control processes.

The establishment in the latter part of 1950 of the State All-Union Conference on Statistical Methods of Control and Analysis of Product Quality at the Academy of Sciences of the U.S.S.R. appears to be a milestone in Soviet attempts to standardize and unify the scientific approach to this problem.[14] Since 1950, numerous meetings between the representatives of the industry and the scientists brought about a mutual understanding of the vexing problems of statistical methods in quality control. Significant in this respect is a recent release by A. N. Kolmogorov, the Chairman of the Conference of the Committee on Standards by the Academy of Sciences, of data on the most up-to-date developments which reveal that the Soviet industry is just about to adopt a standard for acceptance and statistical control. According to Kolmogorov, the task of coordinating a quality control project for a standard was assigned to M. I. Eidel'nant, senior associate of the Uzbek Academy of Sciences.[15] As of Spring of 1957, the project was virtually completed and scheduled for re-

[11] Borodachev, *op. cit.*, p. 10

[12] Bruevich, N. G., "Sovremennoe sostoianie i perspektivy razvitiia nauchnykh rabot o tochnosti v mashinostroenii i priborostroenii." *Izvestiia Akadamii Nauk SSSR. Otdelenie Tekhnicheskikh Nauk*, no. 6, 1956:151-152. (The lecturer besides being a member of the Academy of Sciences, holds a rank of Lt. Gen. of the U.S.S.R. Aviation Engineering Services. During World War II, Bruevich was in charge of Soviet scientific research on problems of precision and reliability for the aviation industry.)

[13] Novikov, *op. cit.*, p. 5-6

[14] Novikov, A. S., *Primenenie predupreditel'nogo statisticheskogo kontrolia kachestva produktsii*, Moscow, Gosenergoizdat, 1955, p. 6

[15] "Soveshchanie po proektu GOSTa na priemochnyi statisticheskii kontrol." *Standartizatsiia*, no. 3, May-June 1957:88-89

view not later than the third quarter of 1957. The release stipulates that the standard is to establish sampling plans and procedures for acceptance inspection; that it is to contain definitions of basic statistical concepts, terms, and pertinent principles; master tables for selection of appropriate sampling plans; tables for sampling plans to reduce the destructiveness of inspection. Furthermore, it is to present recommendations for a comparative evaluation of various sampling plans in comparison with a 100 percent inspection, depending on the size of the lot (N), sample size (n), fraction defective in the sample (p), and losses due to elimination of defectives. The standard is also to present a relatively small number of simple acceptance inspection plans that could be used to accept finished products (piece parts and complex assemblies) and semifabricated items. These are to be geared in such a way that they could label items as good or defective, acceptable or rejectable.

Management Aspects of Quality Control

The management of an industrial establishment is always in need of information on the cost, quantity, and quality of goods produced within a specified period of time. The Russians, until 1951, considered the first two as the integral part of management and treated the quality of goods apart from and secondary to operations generally. Quality control up until then was regarded as a statistical subject divorced from the over-all management of industrial operations. This lack of coordination hampered to some extent the effectiveness of quality control methods which only in part could fulfill their ascribed mission. The attack on waste in 1952 became a concerted drive, spurred by the fact that in 1951 alone the losses attributed to scrap amounted to more than three billion rubles.[16]

Since 1952, the Soviet industrial management began a program of bringing up quality control to the level of importance it had assigned previously to cost and quantity, thus making quality control an integral part of management.[17]

Comment

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[16] Popov, S. G., *Kak predupredit' brak na mashinostroitel'nom zavode*, Moscow, Mashgiz, 1953, p. 65
[17] Gostev, V. I., *Kontrol' kachestva produkstii v mashinostroenii*, Moscow, Gosnauchtekhizd-vo Mashinostroi, Lit., 1955, p. 9-28

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Automatic Statistical Filling Control

a case history

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The Problem

In any operation involving putting a calculated number of tablets in bottles traveling at the relatively high speed of, say, 150 per minute, it is important to know as closely as possible just how many of the bottles actually contain the required number, what percentage does not, and how far above and below the declared amount the defectives range.

This information can be obtained by taking a bottle or bottles from the line at stated intervals and counting the tablets. This method, however, is time consuming and, if the production figures are not to be lowered, the

tablets must be poured back into the bottle by hand. The prohibitive time factor drastically limits the number of samples and this cuts down on the confidence that can be placed in the figures.

The method which will be described substitutes a weight check for the count, and is set up so that production is not interfered with. The samples are picked off the line at random, placed on a machine which empties the tablets, weighs them and refills the bottle in one continuous automatic operation. But let us go back to the beginning of our experimenting which resulted in the adoption of the count by weight check.

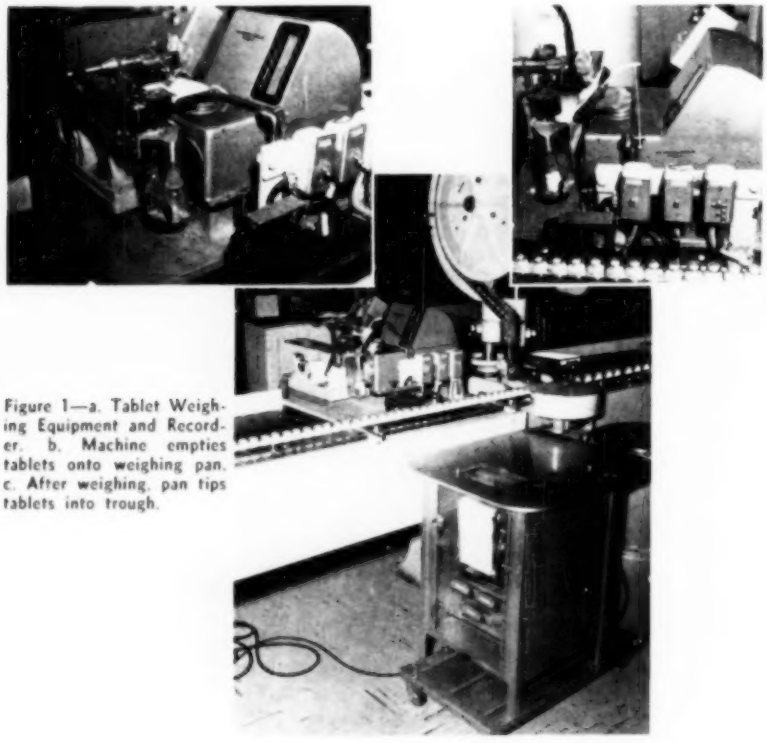


Figure 1—a. Tablet Weighing Equipment and Recorder. b. Machine empties tablets onto weighing pan. c. After weighing, pan tips tablets into trough.

Solving the Problem

Our first approach was to investigate the reproducible accuracy in the weight of 100 tablets. We discounted at once the possibility of calculating the net from the gross weight of the filled bottle, since our experience with glass container weight variability indicated that the variability of bottle weight was several times the weight of a single tablet.

In our manufacturing department, where the tablets are made, a rather careful control is kept on weight variability. Tablet weight is checked frequently by both manufacturing and control personnel and is double checked by control inspectors. Over all presses, covering many months of controlled production, the standard deviation of individual tablets has been brought to the acceptable figure of 0.016 grams in an average tablet weight of 0.565 grams. Expressed in terms of theoretical total weight variability for all four sizes, 12's, 36's, 60's and 100's, the tabulation of σ is as follows:

$\sigma_1 = 0.016$	$3\sigma_1 = 0.048$
$\sigma_{12} = 0.055$	$3\sigma_{12} = 0.165$
$\sigma_{36} = 0.096$	$3\sigma_{36} = 0.288$
$\sigma_{60} = 0.124$	$3\sigma_{60} = 0.372$
$\sigma_{100} = 0.160$	$3\sigma_{100} = 0.480$

It is clear then, that with controlled manufacturing the total weight of 100 tablets will vary less than plus or minus the weight of a single tablet. Therefore, if 3σ control limits were set for total weight of the tablets of any of the sizes produced, then so long as the tablets are running near average weight, an incorrect fill of one tablet in either direction would result in a point out of weight control. Since the total variability spread (6σ) is much less than the weight of two tablets, for all sizes, an incorrect fill of $\pm$ 2 tablets would always be detectable even if the tablets in general happened to be running at the extreme light or heavy end of the control limits. Thus, theoretically the "count by weight" should, even in the hundreds size, detect an incorrect fill of plus or minus one tablet most of the time and a deviation of two tablets whenever it occurs.

The suggested method was tried in the laboratory, using a sensitive torsion balance, and was found to work very satisfactorily. All that remained, then, was to set up the procedure for use in production. This was accomplished with a standard Exact Weight Shadograph balance hooked up with a standard Datamatic recorder (Fig. 1a). With this combination we have found it possible to get 500 or more bottles sampled daily by production personnel on the line without the need of an additional operator. In conjunction with the weighing and recording equipment our engineers at Hillside have assembled a rather ingenious device which permits us to accomplish this sampling *without the loss of any production*. The apparatus consists of a vibrator trough and a tipping balance pan which is operated by a series of relays and timing units. In this operation, the tablets are emptied from the bottle into the hinged balance pan. After weighing and recording, the balance pan tips and the tablets slide into the vibrating trough which feeds them back into the same bottle in a continuous automatic operation.

Detailed Description of the Operation

Before developing this further, let us go back to a description of the entire tabletting operation, starting in the manufacturing department. Here there is a battery of presses punching out tablets. As they leave the press the tablets are collected in fiber drums which in turn are collected on skids or pallets. Any one skid is likely to contain material from *all* presses. The contents of the drums are then transferred to a tablet hopper on the same floor, which has a capacity of about 2000 pounds of tablets. Although there is no mechanical agitation in these hoppers, some mixing does occur as the tablets slide into the funnel shaped delivery exit. (This degree of mixing has somewhat of a blending effect and is helpful in keeping the weight of the tablets filled close to the established mean, which in turn increases the accuracy of the "count by weight" check.) From the hoppers, the tablets are fed by gravity, by means of a 3-in. pipe (constantly full), through two floors down to the filling machines' reservoirs. This operation, using the conventional Lakso fillers, varies somewhat with the size of the bottle being filled, but can be de-

scribed in general as follows: The tablets are automatically dropped into vertical measuring raceways from which they are then delivered into the bottles from one or three of these tracks in one or two shots for a total of either 12, 36, 60, or 100 tablets per bottle. From the filler, the bottles travel to a cottoner, capper, labeller, cartoner, bundler, etc. The sampling station is set up between the filler and the cottoner and one of the line operators operates the weighing device in conjunction with her other duties. To sample, an operator picks up a bottle before it reaches the cottoner and places it, inverted, in a clamp affixed over the hinged tipping pan of the weighing scale. The rest of the operation, until the tablets are returned to the bottle, is automatic.

The act of thrusting the bottle into the clamp activates a vibrator which causes the tablets to spill out onto the balance pan (Fig. 1b). At the end of a short six-second interval to allow all of the tablets to reach the scale, the weight of the tablets is automatically recorded on a chart. (Fig. 1a and 2). Then, activated by a solenoid connected with a timing device, the pan of the balance is tipped, spilling the tablets onto the trough which is set at a slight incline (Fig. 1c). The tablets rest there until another bottle of tablets is placed in the clamp. At this point, vibration automatically applied to the trough causes the tablets to flow quickly into the original bottle placed below the trough to receive them. While the tablets from the second bottle are being spilled out onto the balance pan and weighed, the filled bottle is then replaced on the line and another bottle is removed and put through the same operation. The cycle can be repeated every 15 seconds from the time of inserting the bottle into the clamp to the removal of the refilled bottle. The action is entirely automatic.

In our system, the chart on which the weight is recorded is graduated in ounces avoirdupois, each division being equal to 0.005 oz. (See Fig. 2). Conveniently, four divisions are equal to just about the weight of one of our tablets (0.02 oz. = 0.567 grams; our average tablet weighs 0.565 grams). We have, then, set our upper and lower control limits at $\pm$ 4 lines from the center average line. In all cases these limits are broader than 3σ limits. This we have done purposely. The scale plus the recording device is reproducible only to plus or minus one division. To draw the limits in tighter might mean that occasionally, due to air draft or mechanical mishap, an out-of-control point would be registered when the count was in fact correct. Since we have the line supervisor determine the exact count in any bottles which have been recorded as out of control, it would be embarrassing to have correct fills register as defectives. This would certainly cause the production people to lose confidence in the system. Having the limits at plus or minus the weight of one tablet avoids this difficulty and still permits us to detect defective fills almost 100 percent of the time.

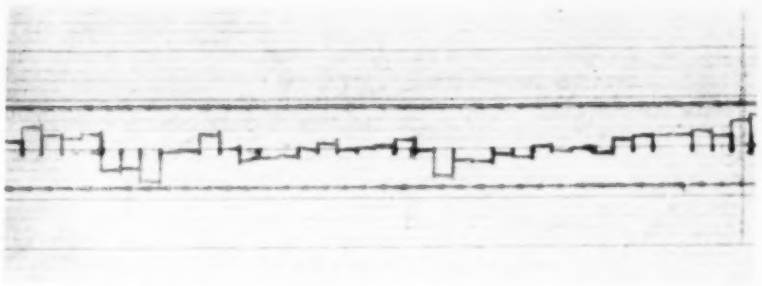


Figure 2—Sample of Datamatic Weight Record (Note Limit Lines at $\pm$ 4 Divisions from Center Line)

So that the operator can catch an incorrect fill without looking at the chart, a set of lights has been connected in the circuit. When a light flashes green the count is correct. When a red light flashes, the count is low. An amber light indicates an overfill.

The bottles are filled at a rate of about 12,000 an hour. Our sampling plan is chosen so that, on checking a minimum of 500 bottles of the day's run, we have a 90 percent assurance of catching an amount of defectives as low as 0.5 percent. Should the Datamatic operator detect an incorrect count her first action is to notify her supervisor. The supervisor in turn checks the defective by counting out its contents manually. If the incorrect count is verified, she advises the filler operator of the observation and encourages her to exercise a little more care. At the end of each day's operation the recording chart is delivered to the Quality Control Department where it is carefully reviewed. Any incorrect counts recorded in a day's run are investigated for assignable causes. It is a well known fact that some operators are more careful than others; this sampling will show up the less careful. Occasionally machine trouble and sometimes tablet trouble have been contributing causes of incorrect fills. In such instances, the chart information has led to corrective action.

Some Results

To check the system we ran counts on cased stock of single day's total production using the same number of samples. After a few days' operation, the following percent defective figures were observed for a three-day period:

Weight Check
by Datamatic ...0.7% 0.75% 1.1%
Case Stock,
Actual Count ..0.8% 0.5 % 0.2%

After the system had been in operation for a few weeks and further perfected, the following comparisons for a five-day period show a marked improvement.

Datamatic 0.4% 0% 0.2% 0.2% 0.7%
Actual
Count.. 0% 0% 0% 0.4% 0.2%

Prior to the installation of this system, the percentage of defects was considerably higher.

An unanticipated result of the use of this check system has been the psychological influence upon the filler operator. She knows she is being continually checked and consequently she exercises more care. Another result has been that the increased attention to tablet count has frequently led to minor machine and operational improvements which made it easier for the operator to assure accurate counts. Changing very slightly the setting of the raceways to prevent tablet sticking, installation of a vacuum system to prevent tablet dust accumulation, and more careful control of tablet thickness are only a few of the improvements which helped materially in attaining better accuracy of fill.

Why It Works

It should be kept in mind that control of tablet count by weighing is posible only because a close control over tablet weight is established in manufacturing. This factor cannot be overemphasized. To cite just one example, we recently made what we

considered a minor change in the process by which one of the tablet granulations was prepared. When these granulations were pressed into tablets, it was soon noted that the variability in tablet weight had increased several fold. With such variation, counting by weight would not be practicable. An investigation was conducted immediately and it was soon learned that poor flow of material from the press feed hoppers was responsible for this marked increase. Further investigation disclosed that the condition could be very neatly corrected by a change in the tablet mixture blending operation. By merely using a different type mixer for the granulation, flow characteristics were markedly improved and normal tablet weight uniformity was restored.

With good control over manufacturing, then, it has been found possible to check tablet *count* with a go, no-go *weight* arrangement. Through the use of a semi-automatic mechanical device it is possible to check the accuracy of the contents of 500 and more bottles per day without the necessity for an additional operator and without the loss of production. This results in a high degree of accuracy in the number of tablets in each bottle going out to the customer.

Inventory Valuation by Sampling

W. E. COURTRIGHT and A. A. PROCASSINI

Argus Cameras, Division of Sylvania Electric Products, Inc., Ann Arbor, Mich.

Introduction

Prior to and including 1955, the annual physical commercial parts inventory at Argus was a 100 percent count of all parts at each operation. It did not include warehoused finished goods, equipment, office supplies, or other types of inventory. The inventory was taken at the end of the fiscal year, July 31 of each year.

For the physical inventory of 1955, 1066 different kinds of parts were inventoried. This operation cost approximately $15,000. The purpose in investigating a sampling approach to inventory valuation was to reduce this expense.

The investigation which is reported in this article led us to believe that sampling was feasible for the valuation of inventory. After the investigation was completed, a committee was established with representatives from accounting, internal auditing, production planning, tabulating, and systems and procedures. This committee modified the procedures, incorporating many useful ideas originating within the departments of the committee members.

Adoption of the new procedures for the 1956 physical inventory resulted in an 85 percent reduction in the cost of performing this operation as compared to 1955. The analysis of inventory control by statistical methods is still continuing at Argus and it is hoped that further improvements can be made in this area.

Former Inventory Procedure

All batches of each part were counted and a ticket written for every batch quantity by part serial number and operation number. The tickets would then be collected and given to the tabulating department. They would compute the dollar value of each batch by using the given quantity and the appropriate cost for each operation. These values were then added to obtain our total commercial parts inventory value.

In addition to taking an annual physical inventory, the production planning department maintains a perpetual inventory record. As parts are received, the quantity is added and as final products such as cameras and projectors are shipped to warehouses, that quantity is subtracted. For example, a component of the C-44 Camera may show a quantity of 1000 on the perpetual inventory record. If 500 were received today, 500 would be added making the total 1500, and by subtracting the days' production of C-44 cameras of 300, it would have a final figure of 1200 for this date. By this means, the quantity on hand is known for production purposes. If a part is made at Argus, the cumulative quantity is posted as produced for each part number.

This was the inventory control and accounting system being used, when the possibility of using statistical methods for inventory valuation was discussed with the controller and production planning superintendent. The controller felt that if the inventory value could be determined with a maximum dollar error of $\pm$ 2½ percent, he would not need a complete physical inventory. The production planning superintendent felt he had good enough control over part counts so that a complete physical inventory was unnecessary.

Experimental Sampling

It was then decided to do the following:

First, collect all records pertaining to the 1954 annual physical inventory and study the two factors of cost and quantity.

Second, discuss the problems involved with accounting, the systems and procedures group, production planning, and other departments.

The tabulating department had available the following records of July 31, 1954:

1. The Perpetual Inventory Record.
2. The Cost List by part serial number and operation number.
3. The Annual Physical Inventory Report for Commercial parts.

An example of these records is shown in Table I.

TABLE I—Examples of Available Inventory Records

ANNUAL PHYSICAL INVENTORY 1954				PERPETUAL INVENTORY RECORD JULY 31, 1954		COST LIST—1954			
PART NO.	OPER.	QUANTITY	VALUE	PART NO.	QUANTITY	PART NO.	OPER.	LABOR	BURDEN	MATERIAL
14129	45	725	$ 21.75	14129	28198	14129 (Make)	45	0.004	0.014	0.012
	50	930	$ 60.45				50	0.014	0.039	0.012
	F	1,070	$ 126.26				F	0.029	0.077	0.012
TOTAL		2,725	$ 208.46							
14204	15	15,000	$ 885.00	14204	30,000	14204 (Make)	15	0.004	0.013	0.042
	F	15,223	$ 959.05				F	0.005	0.016	0.042
TOTAL		30,223	$1844.05							
14221	F	27,232	$ 871.42	14221	25,364	14221 (Pur.)	F			0.032
14508	F	410,028	$ 820.06	14508	404,811	14508 (Pur.)	F			0.002
14810	F	498	$ 18.92			14810 (Sub-Assy)	F	0.020	0.038	
14816	F	4,519	$ 126.53			14816 (Sub-Assy)	F	0.011	0.028	

TABLE IV—Summary of Cost Records

	NUMBER OF PART NOS.	% OF TOTAL	COSTED AT	PERPETUAL INV. RECORD
Purchased	581	54.5	Material Cost	YES
Processed	333	31.2	Labor, Burden & Material Cost	YES
Sub-assembly	152	14.3	Labor & Burden Cost	NO
TOTAL	1066	100.0		

It should be noticed from these records that purchased parts, Argus processed parts, and sub-assemblies are costed in a different manner. Also, that no record is kept during the year of the quantity of sub-assemblies. A summary of this information taken in 1955 is shown in Table IV.

Purchased parts are costed by a constant material cost; however, labor and burden costs for in-process parts are dependent on the number of operations which are completed. Sub-assemblies are costed at labor and burden costs only.

By using figures obtained from the accounting department from the 1954 inventory records, it was found that our in-process total labor and burden cost was approximately 35 percent of a value representing all in-process parts costed at finished labor and burden costs. To show this more clearly:

$$\frac{\begin{pmatrix}\text{Actual Labor and}\\ \text{Burden Cost of}\\ \text{1954 Inventory}\\ \text{(In-process Only)}\end{pmatrix}}{\begin{pmatrix}\text{In-process parts quantity}\\ \text{of 1954 Inventory}\\ \text{Costed at Final Labor}\\ \text{and Burden Cost.}\end{pmatrix}} = \begin{pmatrix}\text{Proportion of}\\ \text{Finished Labor and}\\ \text{Burden Invested in}\\ \text{In-process Parts}\end{pmatrix}$$

This equation is important in that it gives an estimate of the in-process investment.

After analyzing the cost portion of the inventory, records were then studied concerning quantity. It was found that the perpetual inventory record quantities varied from the actual inventory quantities. By taking these two records and computing the ratio of the difference between the two figures to the perpetual inventory record quantity, a measure of its accuracy was obtained.

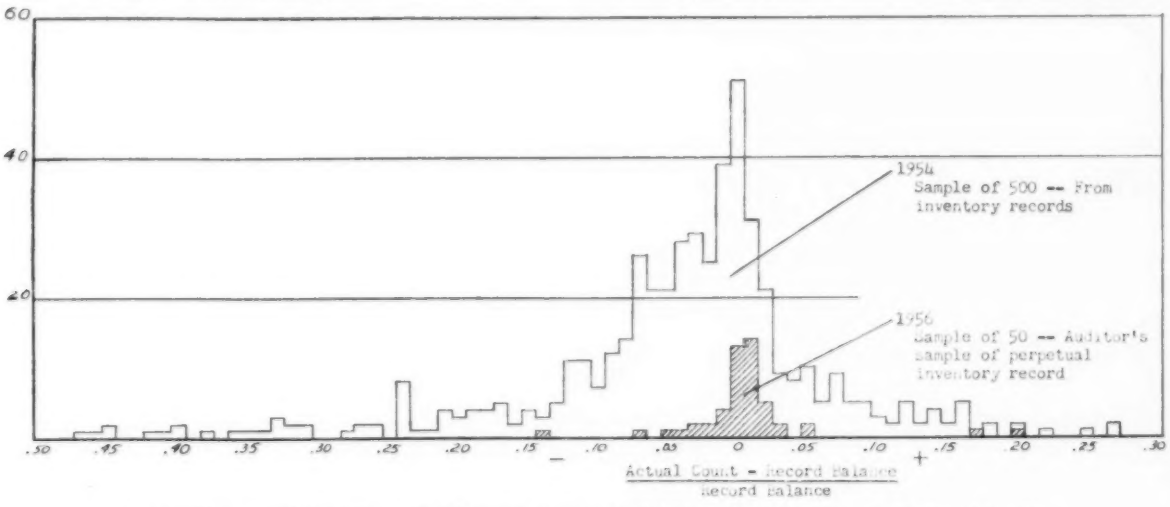

60
40
20
1954
Sample of 500 -- From inventory records
1956
Sample of 50 -- Auditor's sample of perpetual inventory record
.50 .45 .40 .35 .30 .25 .20 .15 .10 .05 0 .05 .10 .15 .20 .25 .30
Actual Count - Record Balance / Record Balance

Figure 1—Histogram of the Ratio of the Difference between the Actual and Record Inventory to the Record Inventory

$$\frac{\begin{pmatrix}\text{ACTUAL}\\ \text{QUANTITY}\end{pmatrix} - \begin{pmatrix}\text{PERPETUAL}\\ \text{INVENTORY}\\ \text{RECORD}\\ \text{QUANTITY}\end{pmatrix}}{\begin{pmatrix}\text{PERPETUAL INVENTORY}\\ \text{RECORD QUANTITY}\end{pmatrix}} = \begin{pmatrix}+\ \text{(GAIN)}\\ -\ \text{(LOSS)}\end{pmatrix} \text{FACTOR}$$

EXAMPLE: PART NUMBER 14503

$$\frac{18{,}252 - 18{,}067}{18{,}067} = \frac{185}{18{,}067} = +0.0102$$

This ratio was computed for a sample of 500 part numbers from the 1954 inventory records and was plotted. The resulting distribution and a sample of the same ratio in 1956 are shown in Fig. 1.

The mode is 0 indicating the most frequent difference is 0. The mean is a negative value and the curve is skewed to the left. The negative values tend to be more frequent than positive values. This agreed with investigations by inventory control that positive and negative values are clerical, delivery, or counting errors. Actual shrinkage or losses account for the greater frequency of negative values.

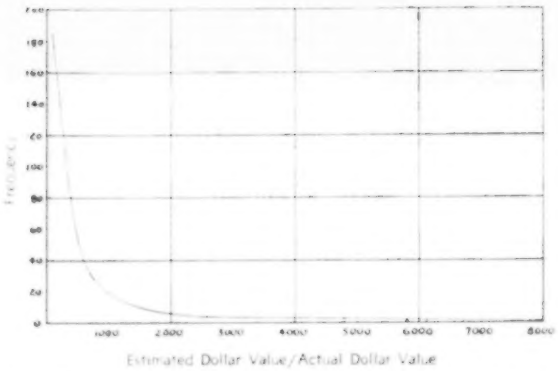


Figure 2—Relationship between Total Investment per Part Category and the Number of such Categories

The two factors of cost and quantity determine the inventory value. Thus far, the basic conclusions have been reviewed from a study of these factors. Because of the conclusions, it was felt that a preliminary estimate of the total value of each part serial number could be made according to the schedule in Table V.

TABLE II—Summary of Inventory Study, July 31, 1955

Category by Est. Part Value	No. of Parts in Group (N)	Sample Size (n)	Average of Sample ($\bar{X}$)	Sampling Error in Average at 95% Confidence Level (R)	Computed Value of Group on Basis of Sample Inventory (NX)	Actual Value of Group Found by Normal Complete Inventory	Percentage of Actual Value
Over $10,000	26	26	—	0	$ 568,744	$ 568,744	58.2
5000 - 9999	30	30	—	0	201,626	201,626	
2000 - 4999	61	37	$3,044	± $209	185,684	187,568	14.1
1000 - 1999	90	25	1,459	± $139	131,310	125,323	9.5
500 - 999	150	15	680	± 69	102,000	109,391	8.3
200 - 499	219	15	378	± 77	82,782	76,823	5.8
0 - 199	316	22	97	± 24	30,652	33,245	2.5
Sub-Assy	174	35	160	± 165	27,840	21,310	1.6
TOTAL	1066	205	$1,245	± $ 30	$1,327,638 Sampling Estimate	$1,324,030 Actual Total Value	100.0

TABLE III—Summary of Actual Inventory, July 31, 1956

Category	No. of Part Numbers	% of Total Part Nos.	No. of Part Nos. Physically Inventoried (July 31, 1956)	Dollar Value	% of Total Est. Dollar Value
Estimated High Value Parts	77	7.1	77	$ 688,608	45.2
Glass (Inventoried for Production Planning purposes)	51	4.7	51	$ 264,997	17.4
Sub-Total		*11.8*		*$ 953,605*	*62.6*
Small Parts	285	26.3	0	$ 113,333	7.4
Remaining Parts (A sample of 50 counted by production planning prior to inventory)	671	61.9	50	$ 456,495	30.0
Sub-Total		*88.2*		*$ 569,828*	*37.4*
Grand Total	1084	100.0	178	$1,523,433	100.0

TABLE V—Schedule for Estimating Total Value of Each Part Serial Number

TYPE OF PART	ESTIMATE
1. Each Purchased Part Serial Number and Assembly.	1. (Material Cost) × (Perpetual Inventory Record Quantity)
2. Each Argus Made Part Serial Number.	2.
A. All Part Serial Numbers Whose Total Quantity Was Completely Finished.	A. (Final Labor Cost + Final Burden Cost + Final Material Cost) × (Perpetual Inventory Record Quantity)
B. All Part Serial Numbers Whose Total Quantity Was Not Finished.	B. [(.35 Final Labor Cost + .35 Final Burden Cost) + Final Material Cost] × (Perpetual Inventory Record Balance Quantity)
3. Sub-Assembly	3. Not Estimated

By using this schedule, the perpetual inventory record and the cost list which were available before the 1955 Annual Physical Inventory, the tabulating department ran the list of estimates. Figure 2 shows the approximate relationship between the total investment in parts of various categories and the number of such categories.

It was found that most part serial numbers were of relatively small total value while few were of high value. Because of this, the distribution of estimates was divided into groups according to estimated dollar value —$0-$199, $200-$499, etc. It was also decided to set a confidence interval and obtain a sample size for each group in order to show the maximum error expected by group. If interested in only total error, optimum allocation of a total sample would have been made.

If the actual value of a group were known, then the value of the group would be equal to the mean value multiplied by the number of part serial numbers in the group. For example,

$$\mu = \frac{\sum_{1}^{N} X_i}{N}$$

where

μ = Actual Mean

$\sum_{1}^{N} X_i$ = Total Inventory Value

N = Number of Part Serial Numbers

If, however, we obtain $\bar{X}$ for a sample of n, we have*

$$\text{est.} \sum_{1}^{N} X'_i = \bar{X}N$$

The sample size required to obtain a specified precision in the sample mean was found by the following equation:†

$$n = \frac{\sigma_p^2 N}{\left(\frac{R}{t}\right)^2 (N-1) + \sigma_p^2}$$

n = Sample size
σ_p^2 = variance of group of estimates
N = number in the group
R = Acceptance Range of Error of the mean
t = Student's t for infinite degrees of freedom
$\frac{R}{t} = \sigma_x$ (standard error of means)

*Statistical Sampling for Auditors and Accountants, Vance, Neter, John Wiley & Sons, Inc., 1956, Page 181.

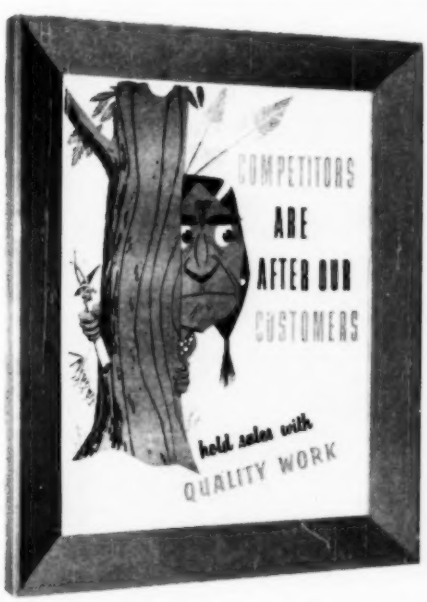
†Statistical Sampling for Auditors and Accountants, Vance, Neter, John Wiley & Sons, Inc., 1956, Page 193. Messrs. Vance & Neter do not use this exact equation because they use N in place of (N—1).

After the sample size was computed for each group, the samples were chosen at random from the list of part numbers of each group.

Computation of Inventory Totals

At the same time as this work was being done, a 100 percent physical inventory was being carried on in the plant. When the inventory was completed, inventory values of only those part numbers which were included in the samples were requested. The mean and variance of the sample was calculated and the inventory results are shown in Table II.

This study confirmed the belief that statistical sampling methods could be used to arrive at a realistic inventory evaluation.



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Review and Modification of Sampling Procedure

On completion of this study, meetings were held by a committee from accounting, production planning, systems and procedures, and quality control. The results of the above study were explained and discussion begun on using a method other than 100 percent physical inventory which would be acceptable to the auditors and management.

For the annual physical inventory of 1956, the decision of the committee was to use the inventory method which is described here.

As compared to the 1066 different parts to be inventoried in 1955, there were 1084 different part numbers in use in 1956. This difference was due to the addition and deletion of products to our product line, engineering changes, etc.

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The 1084 part numbers were divided into 4 categories:

1. Estimated High Value Part Numbers
2. Glass
3. Small parts (inexpensive purchased hardware, screw machine parts, etc.)
4. Remaining part numbers.

Table III shows the results of this inventory.

The 285 small parts were placed in a central storage bin during the year prior to inventory by production planing, and a continual count was kept. This method of control requires some counting but not to the degree of a 100 percent physical inventory, since tags showing the quantity of each part number are attached to the containers.

Of the remaining 671 parts, the auditors were satisfied with a random sample of 50 part numbers. These were counted by the cycle inventory group under the supervision of the auditors. On the basis that the actual counts varied from the perpetual inventory record balance within an acceptable range, the perpetual inventory record was costed at material, and a factored labor and burden rate for Argus-made parts and sub-assemblies, while purchased parts were costed at material only.

Although this inventory is different in some ways from the first proposal, the basic principles are the same:

1. Completely inventory part numbers of high value.
2. By a method of sampling, obtain a valuation, or acceptance of current records for costing for the remaining part numbers.
3. The total error is based on both groups, therefore a small overall error can be obtained by a physical inventory of a small number of high value parts, and a record, or sampling inventory of a large number of low value parts.

The annual inventory of 1956 resulted in an overall savings of 85 percent of the cost in 1955.

Further Investigations

Quality control contributed some ideas in this effort, but much of the credit goes to people who have done the work in planning, tabulating, systems and procedures and accounting. Work is continuing in the area of inventory control.

The distribution of Fig. 1 indicates that the accuracy of the perpetual inventory record can be improved. To this end, work is continuing. The variability expected in this distribution is known from distributions taken from the annual inventories of 1954, 1955 and 1956. Subgroups of four part numbers have been taken and the loss or gain ratio plotted on an $\bar{X}$ and R Chart. This informa-

tion will be used in terms of dollars as well as quantity. As this information is accumulated, it will be easier to see if this variation can be reduced. This work may eventually result in no physical inventory whatever, but an accurate evaluation by use of records only.

With some of this past work put into practice and discussed here and the description of further work ahead, Argus can see the gains of a team approach where quality control definitely has something to contribute to the other members.

From the Scrap Box

MASON E. WESCOTT, *Editor*

University College, Rutgers University, New Brunswick, N. J.

A Team Approach to Process Development

EDWARD J. BRAZILL

The Martin Company, Baltimore, Md.

Since July 1955 The Martin Company Quality Division has participated in the development of standard processes from the early research phase on through engineering and manufacturing. We have made processes the mutual concern of all interested divisions and thereby have been able to cut down process problems before they can reach serious proportions and affect production.

The engineering, manufacturing, and quality divisions are all represented in process development through the pooled knowledge of material engineers, manufacturing engineers, and quality research and development engineers. Interaction of all team members is the key to fulfillment of the total responsibility.

Our processes are concerned chiefly with the chemical and metallurgical aspects of materials used in the manufacture of aircraft and missiles. They define industrial procedures for plating, painting, heat treating, welding and other operations.

Setting a Process in Motion

As shown in Fig. 1, the demand for a new process originates with engineering and the work gets under way in the engineering materials laboratory. This center prepares a so-called X process (X for experimental), and then subjects it to laboratory tests to determine its suitability for production application. Preliminary specifications and material control information are incor-

(Continued on page 24)

Author's Note

The Martin system of process development served as the theme of our exhibit at the May 1957 convention of the American Society for Quality Control. This article is offered in response to the numerous inquiries we have received.

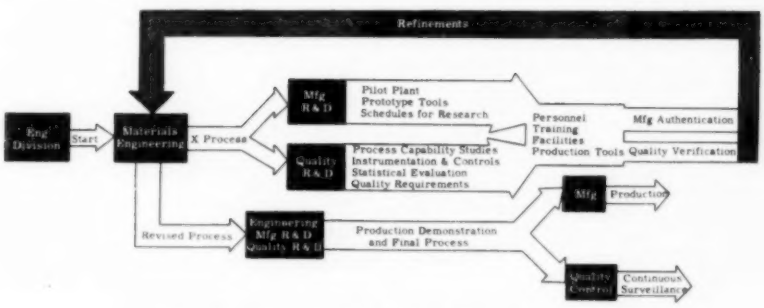

Figure 1—Development of a Martin Standard Process

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TECHNICAL PROGRAM

The program format of sixty-four speakers has been designed to provide exceptional presentation and to allow more time to participate in the other features of what promises to be the best ASQC Convention to date.

PLANT TOURS

Several plant tours have been planned to meet the demand of this highly popular activity. Since the size of the tours must be limited, early registration is advised. A modest, special registration fee is required to assist in defraying the cost of this function. Tickets will be available in the registration area.

Arthur D. Little, Inc.
Dewey & Almy Chemical Co.
Western Electric Co.
Gillette Safety Razor Co.
Keystone Camera Co.
Walter Baker Chocolate Corp.

LADIES PROGRAM

Beginning with the Open House Sunday evening there will be many attractions—including the popular daily hospitality hours, a flower show, a luncheon at an historic Boston eating place, tours of modern and historic Boston, social affairs every evening, or just shopping at leisure in Boston's famous stores.

EXHIBITS

The high degree of interest evidenced in our exposition reflects constant growth. A great many registrants come primarily to observe these presentations of the latest developments in the tools, procedures, methods, and practical applications of Quality Control. In contrast to the usual hotel type of exposition, our presentation has been designed to afford increased attention to the exhibits. We strongly recommend your close attention to this unusual and informative show.

BOOK BOOTH

There will be a wide variety of books to fit your needs; ranging from elementary Quality Control training to higher mathematics and statistics, as well as those on allied subjects. Professional sales people will be available to give you competent advice on the latest texts in the field. Prominent authors will also be present to chat with you and autograph your purchases.

DIVISION MEETINGS

A series of dinners have been scheduled for 6:30 pm at Hotel Statler on Monday to precede the annual meetings of the following groups:

Admin. Applications Division
Aircraft Division
Automotive Division
Chemical Division
Electronics Division
Textile Division
Metals Technical Committee

COPIES OF TRANSACTIONS

Copies of the transactions will be available in bound volumes for $3.00 each at the Convention only. Copies may also be obtained by mail for $3.50 by writing to the American Society for Quality Control, Room 6197 Plankinton Building, 161 West Wisconsin Avenue, Milwaukee 3, Wisconsin. They will not be mailed until after the Convention.

SOCIAL EVENING

One of the outstanding activities of each Convention is the opportunity to mingle with old friends and new during the main social event of the Convention program. The beautiful ballroom of the Sheraton-Plaza will house Monday evening's gala affair—with dancing, refreshments "on the house," and other new and different features. Be sure to attend.

ASQC Convention Exposition Chart

12TH ANNUAL CONVENTION AND EXPOSITION
HOTEL STATLER • BOSTON, MASSACHUSETTS
MAY 26 - 28, 1958

HIGHLIGHTS

CONVENTION PAPERS TO COVER CURRENT QUALITY CONTROL PROBLEMS . . .

At no time in the history of American industry has there been a greater demand by the producing concerns, both large and small, to push out more production at greater quality than today. Our labor week is growing shorter. Demands of our growing population for products are becoming greater. The answer to this mounting problem is QUALITY CONTROL. We have to get more out of our work hours and increase the quality of our products to insure less waste. The convention of the American Society for Quality Control in Boston, May 26, 27, and 28, features over 60 papers to be presented by the world's most outstanding authorities in the Quality Control field.

These papers, some written after years of careful study, cover a wide variety of industrial operations and offer a pool of knowledge which can be sifted and readily applied to meet the current demands of your industry. Here are some of the men and the titles of the papers they will present: Chemical Division, Dr. George E. P. Box, of Princeton University, has prepared a paper on "Evolutionary Operation;" Manufacturing and Assembly Committee, August B. Mundel, Sonotone Corp., Elmsford, N. Y., "The Role Of Statistical Quality Control In Assembly Operation;" Administrative Applications Division, Prof. Grant I. Butterbaugh, University of Washington, Seattle, Wash., "Application Of Statistical Methods in Business Administration;" Automotive Division, Leonard G. Johnson, G. M. Research Staff, Detroit, Mich., "Optimizing A Life Testing Program;" Electronics Division, B. J. Kinsburg, Bell Telephone Lab., Murray Hill, N. J., "Distribution Requirement Specification;" General Interest, Paul C. Clifford, Montclair, N. J., "Control Charts Without Calculation—Some Modifications and Some Extensions;" Enoch B. Ferrell, Bell Telephone Lab., Murray Hill, N. J., "Statistical Methods In Engineering Design;" Metals Technical Committee, Warren E. Jones, Management Controls, Des Plaines, Ill., "Exploring Electrochemical Processes;" and in the Textile Division, Dr. W. J. Hamburger, Fabric Research Labs., Inc., Dedham, Mass., "Role of Research For Improving Quality."

Yes, there are over 60 outstanding papers in all, prepared by renowned quality control experts, so you can see the wide scope and importance of this Boston convention.

EXPOSITION TO FEATURE MANY NEW EXHIBITS . . .

We're sure it's not due to Sputnik, but our convention exposition of quality control products, services and systems, promises to be BIGGER and BETTER this year with 23 firms already signed for exhibit space.

You'll share our enthusiasm when you know we'll have quite a few new faces to add to our regular standbys, with a number of them showing for the first time. Among the new ones, who promise to offer exciting and informative displays, are Radio Corp. of America, Camden, N. J., The National Electric Instrument Co. Inc., Elmhurst, N. Y., Simonds Saw & Steel Co., Fitchburg, Mass., who will show how they employ QC in their operations; and The Magnaflux Corp., Chicago, Ill., back again as an exhibitor after five-years' absence to show nondestructive testing methods and equipment.

CONVENTION COMMITTEE COMPLETING FULL PROGRAM OF EVENTS . . .

Your Boston convention committee is working feverishly to round out a complete program for the three days in the old and historic city, which includes many unusual tours and features to be announced. To make sure you will enjoy your convention stay, and widen your acquaintance in the QC field, several informal gatherings are being planned. And of course, the wives and other feminine guests will be assured of a good time, for a special committee is working on this phase of the program.

As we said, it promises to be the BIGGEST and BEST. Plan now to attend and take advantage of this highly informative meeting.

Do you sell a product, a system or a service made for Quality Control? If you do, you can reach thousands of your potential customers at this Quality Control Exposition. For space and information, contact—

ANDREWS, BARTLETT AND ASSOCIATES, INC.,

1849 W. 24th St., Cleveland 13, Ohio

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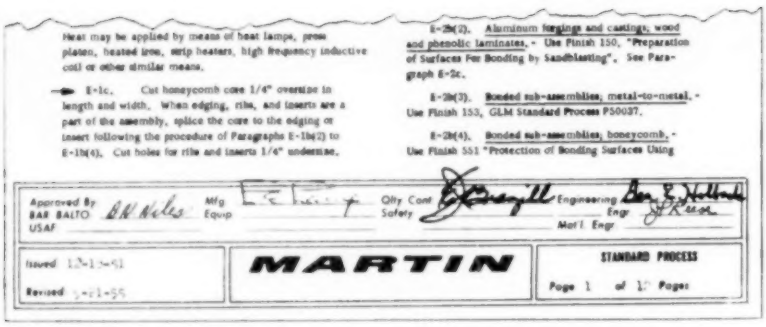
Heat may be applied by means of heat lamps, press platen, heated iron, strip heaters, high frequency inductive coil or other similar means.

E-1c. Cut honeycomb core 1/4" oversize in length and width. When edging, ribs, and inserts are a part of the assembly, splice the core to the edging or insert following the procedure of Paragraphs E-1b(2) to E-1b(4). Cut holes for ribs and inserts 1/4" undersize.

E-2b(2). Aluminum forgings and castings, wood and phenolic laminates. - Use Finish 150, "Preparation of Surfaces For Bonding by Sandblasting". See Paragraph E-2c.

E-2b(3). Bonded sub-assemblies, metal-to-metal. - Use Finish 153, GLM Standard Process P50037.

E-2b(4). Bonded sub-assemblies, honeycomb. - Use Finish 551 "Protection of Bonding Surfaces Using

Approved By BAB BALTO USAF — Mfg Equip — Qlty Cont Safety — Engineering — Engr — Matl. Engr

Issued 12-13-51

Revised 7-21-55

MARTIN

STANDARD PROCESS

Page 1 of 12 Pages

Figure 2—Approval Signatures Reflect the Company-Wide Collaboration that Goes into the Development of a Martin Standard Process

(Continued from page 21)

porated along with any drawings of sample production hardware. The complete X process, along with test data, is turned over to manufacturing engineering and quality research and development.

Feasibility Study

Next the feasibility study begins. Working with quality research, manufacturing research prepares a development plan schedule of activities. They may use factory equipment or set up a pilot plant operation, simulating the factory environment. Prototype tools are designed and built, and hardware manufacturing schedules are set up for the X process. Pilot plant products are evaluated in the laboratory by quality R&D.

When the pilot plant has turned out a significant number of acceptable lots, these steps are taken by manufacturing R&D:

(1) The factory production tools, facilities, and equipment are built, selected, or ordered;

(2) Training requirements are determined; factory and quality line inspection personnel are selected and trained;

(3) Factory layout is arranged for the whole process;

(4) Standards and methods department is consulted about developing job standards and methods, and about performing time and motion studies.

This feasibility phase is marked by conferences among engineers from all three divisions operating as a team. They discuss the accumulated results and set up final specifications and design applicability.

The process is verified by quality research engineers to ensure that the specifications are realistically adapted to the factory environment. Part of this verification is a series of process capability studies. Trouble spots are detected and the variance is analyzed by statistical techniques. Quality control training is evaluated. A significant number of lots are inspected for acceptance, and operator qualification is established where necessary.

All refinements proposed for the X process as a result of the feasibility study are discussed with materials engineering for incorporation into the final process.

Production Demonstration

Following the feasibility study and the creation of a means for producing, training and tooling, a production demonstration is held. Hardware produced in accordance with the process is sent to the quality laboratory for qualification testing. The product must satisfy materials engineering, manufacturing research, and quality research. Then the process is declared standard. Representatives of all three divisions affix their signatures (as shown in Fig. 2), a number is assigned, and the new process is placed in the Standard Process Manual. Thereafter it is used in production.

Follow-Up Control

The Quality Division continues to monitor the control requirements of the standard process in the factory. The quality engineer gets reports of discrepancies and then analyzes the problem, using statistical techniques as they are indicated. His findings are reported to materials engineering and manufacturing research. The process is amended accordingly.

Three distinct points of view—those of engineering, manufacturing, and quality control—are thus brought to bear on standard processes at Martin. Their combined action takes effect before manufacturing begins and the most expensive mistakes are averted. This team approach to standard processes has paid off in a high order of engineering, tooling, and quality for Martin products.

What Constitutes the Total Price of a Purchase*

R. CALVERT HAWS

Quality Control Engineers, Inc., Los Angeles, Calif.

When a buyer gives a vendor a purchase order, the price appearing on the order is in most cases far from being the total cost of the item because there are many functions involved for which costs are not included in the price appearing on the purchase order.

To arrive at a final conclusion, the basic facts must be stated. Let us set forth what constitutes a purchase. Where does it begin, and where does it end?

The purchase begins when a need exists and the buyer sets forth to buy.

*Presented before the Purchasing Agents Association of Los Angeles, University of Southern California, Nov. 21, 1957.

The purchase ends when the need has been satisfied and the vendor paid in full.

In the industrial field, between these two simple happenings, there are today many and varied functions. Originally these were simple because the need was mostly for raw materials, the companies were small, and the owner was one of the men at the bench.

However, as industry grew and intricate machinery took the place of hand labor, manufacturers turned more and more to other manufacturers to supply them with subassemblies, or component parts, which were incorporated into the

finished product. The result has been that today we have hundreds of thousands of large and small businesses unknown to the consumer, which are performing millions of dollars of subcontract work.

Thus, the manufacturer is faced with a big problem. Instead of his purchases being confined to raw materials, he has to rely on others not under his direct or trusted delegated supervision to supply him with items which affect the success or failure of his product.

Naturally new techniques had to be developed, for now the manufacturer is dependent upon sources of supply over which he has little or no control.

In large companies, management found itself dealing with as many as twenty-five thousand suppliers, and even most medium-size companies have as many as three to five hundred.

How could management be sure that these companies could and would fulfill their contractual obligations?

For years companies had found it necessary to use inspectors within their plants to be sure that their products were made according to the engineering specifications. But this was not enough; as has been often said, "You cannot inspect quality into a product."

About twenty-five years ago a new conception was born to insure quality being built into the product, and it was given the name "quality control." Today, under different names and different forms, quality control is a recognized function in most companies. And while there is still much confusion as to the difference between quality control and inspection, perhaps a simple statement might clarify the difference. Inspection says, "Thou shall not pass," but quality control says, "Thou shall not start." In other words, quality control prevents mistakes, inspection points them out.

With such tools at hand it was obvious that both quality control and inspection should be used by the purchasing department to check a prospective vendor. This would be done to determine: first, if he were capable of producing the article to be purchased; and second, to keep him in line after he received the order. All of which became part of the cost of procurement.

Briefly let us analyze some of the functions involved in this outside work.

The vendor. There are many types —let us look at a few.

(a) The one that's out to get a quick buck, and who cares little about anything else; he promises anything.

(b) The one whose business has grown so fast he just can't catch up.

(c) The old-timer who has no use for new-fangled ideas.

(d) The one whose knowledge is limited, and although he tries, new conceptions of his responsibility are just beyond his comprehension. He never reads the small print on the order.

(e) The up-and-coming vendor who recognizes today's exacting standards and puts forth the effort and money to comply with his contractual obligations. He *reads* the small print on his order, and *delivers.*

(f) The one whose business has outgrown his capital requirements and who cannot finance the volume he has secured, so he cuts every possible corner.

When a salesman presents a card and makes a good "pitch," and names an attractive price, is that enough evidence of his ability to perform, by delivering on time, quality material that meets specifications? Hardly! What, then? How about the pictures of his plant, samples of work he has done, lists of people for whom he has done and is doing work, lists of test and production equipment, etc. Still not enough. How come? In buying there is only one answer—you must know beyond a shadow of a doubt that the vendor has the ability and will to fulfill his contractual obligations. This information can be obtained from one source only, and that is the vendor's plant.

A survey to determine a vendor's capabilities consists of much more than a walk through the vendor's plant, and it should be done by men who have this as their sole responsibility. Too often questions asked over a luncheon table actually should be checked on the spot in the plant, and again it should be done by men who do not have any further interest in the vendor. Otherwise, in the event of trouble, there is a tendency for the surveyor to minimize the trouble so as to justify and back up his original report.

As an example, let us consider the survey of a job shop; it should cover in detail—administration, quality engineering, blueprint and specifica-

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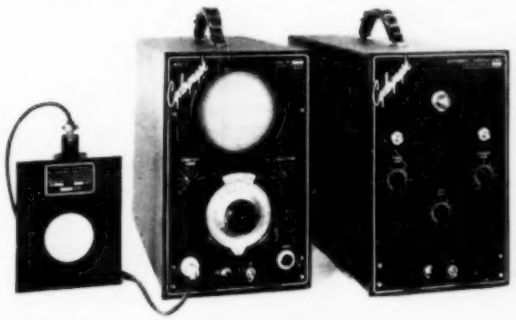

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This instrument permits truly high speed, non-destructive sorting of raw, semi-finished or finished parts by their metallurgical characteristics. With the new Automatic Sorter Unit speeds up to 300 pieces per minute are possible with the use of suitable feeding equipment. Used by leading industrial firms everywhere.

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tion control, purchasing, receiving, production control, in-process inspection, tools, gages and inspection equipment, material handling, salvage or M.R.B. control, packaging and shipping, stock room control, and finally maintenance of adequate records covering all of the above functions. In addition, the survey should cover the number of production employees, inspectors, quality control and other personnel employed, safety measures employed, fire precautions, good housekeeping, etc. Also names of clients (companies for whom current work is being done) and the kind of work. Divisions of government for whom work is being done and percentage of output for government and commercial; delivery time; total floor space and amount in actual use; tolerances held and finishes, also processes available. A detailed report on each of these items with a list of production and test equipment provides the buyer with a picture from which he can decide the advisability of placing or not placing an order with the vendor—a factual picture and not an opinion. From this report the buyer has a real basis for placing an order, just as the credit department has a Dun & Bradstreet to consult before the granting of credit.

CHIEF QUALITY CONTROL ENGINEER

Precision electro-mechanical products company requires chief engineer to head quality control engineering department. Electronics or industrial engineering degree necessary, plus a minimum of 5 years technical supervisory experience. Background in statistical theory desirable.

An excellent opportunity for someone to advance within a growing organization which is the leader in its field. California location with ideal living conditions.

Forward personal resume to address shown below. All replies confidential.

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American Society for Quality Control

Room 6197, Plankinton Bldg.

161 W. Wisconsin Ave.

Milwaukee 3, Wis.

Often there are cases where the nature of the work justifies a buyer giving an order to a vendor who is small and would get a poor rating under the above, but this will apply to not more than 10 percent of the orders placed, and can be quickly spotted in a comprehensive survey report.

♦ ♦ ♦

In R and D the engineer can take such a report and go over it to see if the vendor has the "know-how" and equipment to produce a prototype part, for often a vendor can do an excellent job in producing such a part but would be lost with a production order. This saves the engineer's time which is often an item of cost not readily seen or added to the cost of items purchased. A comprehensive survey would bring out this information at a fraction of the cost of an engineer's trip to the vendor's plant.

Recently, a bank made a loan of $50,000 to a company which took on a job it was not equipped to handle, and it lost $75,000 on the contract. It paid back the bank loan but reduced its assets by the loss, and was that much less desirable as a future borrower. A proper survey would have brought these facts to the attention of the bank and it probably would have saved the company from undertaking a project which could not be handled successfully. Obviously the buyer also paid heavily.

There is one other point that should not be overlooked. Few surveys are current after 90 days. Changes in personnel, even changes in employees' private lives, all have their effect on the quality of the output of a plant.

It can readily be seen that many of the later additional costs would be avoided if the first step in procurement is completely and accurately executed.

Too often situations which existed when the purchase order was placed, but, because of incompetency or carelessness, were not detected, come to light long after the order has been issued.

Be sure that your vendor survey is comprehensive, inclusive, and done by experienced operators. Be sure that it does not reflect opinions only, but is a statement of facts verified by on-the-spot checks of visible and tangible evidence. The honest vendor has nothing to hide and welcomes such a survey.

This is no job for a top sergeant; it requires the utmost in diplomacy to get the best results at the lowest cost. Resistance, "snow" jobs, and even arguments do not contribute anything to the job in hand. The operator does not have to impress the vendor—most vendors have been surveyed before, and in most cases the vendor or his employee is anxious to get back to his desk.

Surveying of vendors is an endless task, but the rewards are great and the savings tremendous. From our experience, 90 percent of the trouble and additional costs would never have happened had the purchaser known more about his vendor when he placed the order, and this applies to all purchasing.

An Example

In the soft goods department of a large department store, they were having a heavy return on a cotton house dress. We found that the manufacturer was having the work done on a piecework basis. At the time the garments were being made, they also had a ladies' winter coat going through. This required that the operator change her needle for each type of material. But this took time and cut down the operator's earnings. A large needle was used for the winter coat, and the same was also kept on the machine for the house dress. The result—while the coat held together, the heavy stitches in the gament of lighter material quickly came apart. This could have been avoided by proper supervision and inspection, both of which were lacking. These factors would have been brought out in a survey and the department store would have been saved considerable loss and many irate customers.

Another item of procurement cost is receiving inspection.

Inspection charges, both source and receiving, cannot be overlooked as a hidden cost of procurement. Most vendor plants are overloaded with the outside inspectors of their clients. It has been the history of the aeronautical industry that the buyer has taken over this function to such an extent that many vendors assume the attitude of *Caveat Emptor*, and have turned over the responsibility and cost of inspection to the buyer.

A decision to use source inspection, rather than receiving inspection, involves the weighing of costs and of being sure in the original survey that the vendor has the personnel and equipment to do a thorough inspection job before making shipment.

If the order sets up 100 percent source inspection, describing the method and equipment to be used, then at a small cost, checking of the equipment and inspection methods used by vendor employees, together with a random check or even a 100 percent check of items ready for shipment, can assure the buyer of quality merchandise he can use without further check on many items, and source inspection will result in keeping receiving inspection costs to a minimum.

• • •

The great advantage of this method over receiving inspection is the savings in cost of test equipment, time of setting up and taking down equipment, costs of repacking and re-shipping of rejected material with all the attendant paper work, and finally, the cost of maintaining a large staff of receiving inspectors.

Receiving inspection can involve costs running into hundreds of thousands, and in some instances millions of dollars. In most cases it functions under quality control and inspection budgets, but it is a procurement cost.

Recently a news report cited the case of a company having rejected over 1500 pieces of an order which their receiving inspectors found unacceptable. The discrepancies were not discovered until the merchandise had been shipped nearly 3000 miles. One can readily imagine the costs involved.

It is true that there have been instances where merchandise has been correctly inspected prior to shipment, but found unacceptable when it arrived at the buyer's plant. Often in such cases, poor packaging and environmental and climate deterioration can be pinpointed as the cause for rejection. These, however, are the exceptions. In general, savings realized by source inspection compared with receiving inspection costs are considerable—when all the factors are considered.

A not inconsiderable hidden cost of receiving inspection involves time consumed both by the vendor and buyer when the vendor is requested, or requests, to inspect material before it is returned. This expense would not occur in the use of source inspection, which permits immediate corrective action. It also permits forwarding of a sample rather than a shipment to the buyer for M.R.B. action.

There is one other point. Often the rate of rejection can become quite high *without* the vendor realizing the percentage involved. He only regards rejections as those parts actually returned to his plant. Source inspection brings all rejections to his attention.

Too often the buyer accepts parts at the last minute or does rework (a costly procedure when all the factors involved are figured) in order to avoid line delays and resultant additional costs. In some cases the buyer makes back charges, the collection of which again takes time and effort, further adding to the costs, to say nothing of the breakdown of good vendor relationship.

These are but a few examples; in addition there is the cost of expediters, time and travel expense, long-distance phone calls, etc.

It can readily be seen, therefore, that the cost of procurement is generally many times the cost appearing on the purchase order.

What's New?

ROY A. WYLIE, *Editor*

When inquiring about "What's New?" items, please mention INDUSTRIAL QUALITY CONTROL

A new one-pan analytical balance for weighings from 0.1 milligram to 200 grams has just been announced by the Christian Becker Division of the **Torsion Balance Co.**, Clifton, N. J. The new design features a

Two-Beam Construction. All weighings from 1 to 200 grams, are made to within 1 gram on a "rough-weighing" beam. The operator does not have to watch the reticle during the "rough-weighing." Two amber lights, positioned at eye level, indicate which way the weight control knob should be turned to adjust the balance to within 1 gram. All weighing adjustments from 0.1 milligram to 1 gram are made on a "fine-weighing" beam and are made completely automatically. This Two-Beam Construction reduces knife edge wear on the "fine-weighing" beam and prolongs the accuracy of the balance. A new concept in reticles and verniers is also incorporated in this balance. Larger and easier to read than conventional projected images, this new optical system produces an image of 10,000 parts, each part being 0.1 milligrams. In addition to these features, this semi-automatic balance is temperature compensated, provides large unobstructed access to the weighing chamber, has conveniently placed weight control knobs, and oil damping.

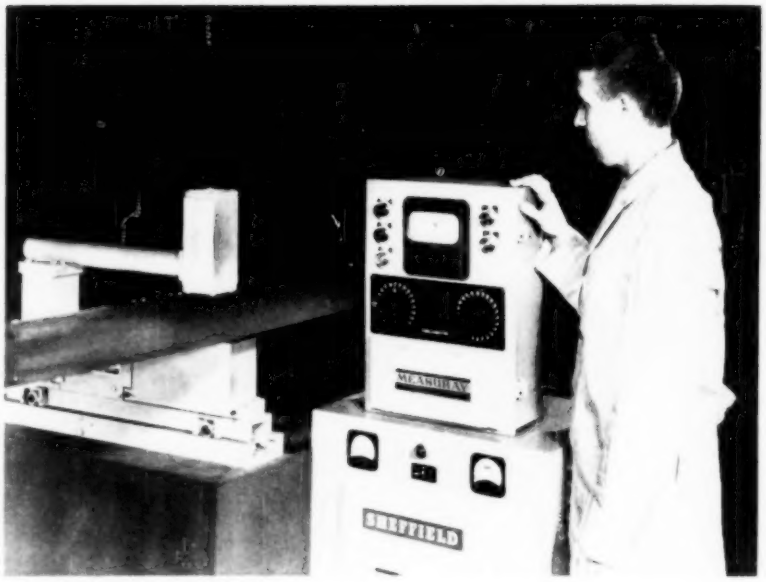
★ ★ ★

Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis 18, Ind., has developed a new Model PC-1A proportional counting system for precise radioactivity-counting. Designed for highly accurate counting of any type of radioactivity from samples introduced into the counting chamber, it counts alpha in the presence of beta, and the total of alpha and beta-gamma. It is capable of counting every alpha and every beta emitted from the sample regardless of their energies. The Model PC-1A may be used for work in quality

control, calibrating radioactive standards, plant physiology, soil sampling and hydrocarbon chemistry. New features of the instrument include low power requirements, industrial type transistors and printed circuitry. Other features include binary scaling unit, automatic gas purge system with variable purge time, preset timer and gas flow proportional counting chamber. Dimensions are 22 × 12½ × 15 inches. The price is $980.00, FOB, Indianapolis.

* * *

Low-intensity X-rays in split-second pulses can scan film and foil speeding by at 100 feet per second, and measure strips 0.002 of an inch thick with accuracy of millionths of an inch in a new type gage developed by **The Sheffield Corp.**, Dayton 1, Ohio. By using pulses instead of continuous radiation, Sheffield's new Measuray gage pinpoints changes of thickness even at extremely high speeds of strip production. At 600 pulses per second the new X-ray gage provides an individual thickness reading every third of an inch on foil fed through at 1,000 feet per minute. The Measuray gage measures instantly and accurately a wide range of materials produced in continuous strips; such as foils made of steel, aluminum, copper or brass, as well as sheet and bar stock. It will also measure various types of plastic film thickness. The X-ray pulse passes through a strip that comes between the emitter and receiver of the scanning unit. The receiver detects and amplifies the X-ray energy that manages to get through. A slight increase in thickness means less energy received. Detecting and amplifying this difference, the new gage then registers it on an indicator in millionths of an inch or as deviation in percent, plus or minus. Negligible wiggle, or random movement, of the indicator needle makes the new Measuray gage easier to read. The indicator is located in a remote control station. X-ray scanning unit and main power cabinet make up the rest of the Measuray X-ray thickness gage. Its ultra-fast cycle allows the new gage to be used with high-speed electronic counting, marking and sorting devices. It can also be used with production analyzers, automatic thickness controllers, recorders, totalizers and other accessory devices.



"QUALITY MEANS BUSINE$$"

Theme of the Fifth Industrial Clinic for Quality Control

Sponsored by the Milwaukee Section, ASQC, with the cooperation of the Wisconsin Manufacturers' Association.

Date:	Complete Registration Fee:	Place:
March 14, 1958	ASQC Members $12.50 Non-Members $17.50	Wisconsin Hotel, Milwaukee

Program of 12 sessions will feature outstanding speakers in brewing, electronics, metalworking, and various general interest topics. Use the convenient coupon below for your advanced registration form . . .

5th Industrial Clinic for Quality Control
Box 1204, Dept. Q
Milwaukee 1, Wis.

Please send.....programs and advance registration forms to:

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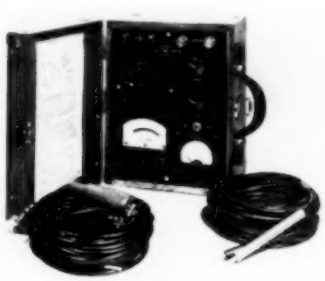

The J. W. Dice Co., Englewood, N. J., has introduced the Microhm Meter specifically designed for making highly accurate surface resistance measurements in the microhm range. The meter checks "cleanliness" of

Electronics Division News

The Division held a "get acquainted luncheon" in conjunction with the 4th National Reliability Symposium. Chairman Irv Schoeninger reviewed the plans of the technical publications committee for a production and field service reliability handbook and a compendium of short cut statistics. Contributions for either should be sent to Dick Myers, Hughes Aircraft Co., Culver City, Calif. Other members of Dick's committee are B. Goldsmith, G. Armour, H. Dwyer, and J. Stevenson.

The education committee under Frank Gryna's chairmanship is making plans for a short course in reliability to promote statistical courses in electrical engineering curricula. Other members of his committee are H. Hadley, M. Jacobs, S. Calabro, A. Roddey, S. Richards, and L. Paddison.

The Division is planning to send free copies of the symposium transactions to all members who did not attend. This is a 5 to 1 return on the membership dues since ordered separately the transactions cost $5. Division members who contributed to the 4th symposium were thanked for their efforts.

A Division council meeting was held on Jan. 5. The chairmen of the technical publications and education committees reported on their progress. The policy committee's list of duties for officers and councilors was reviewed. The object of this work is to improve the effectiveness of the Division's operations.

Since the division is planning now for the 1959 and other ASQC conventions, any papers should be sent to G. H. Beckhart, Bldg. 10-6, RCA, Camden, N. J.

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The Martin Co.

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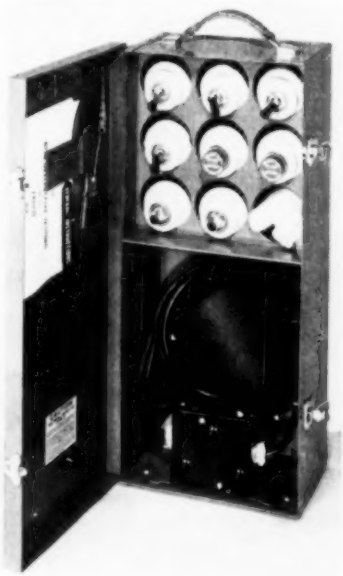
P. O. Box 368, Rahway, N. J.

aluminum or other sheet material—an essential step in maintaining quality control of spot welding. Low surface resistance shows material is clean and should weld properly. The microhm meter measures resistance of coupons in a test jig or the resistance of actual sheets at the welder head. The meter reads directly in microhms on the 0.75 range and a selector switch cuts in multipliers for four additional higher ranges.

* * *

Magnaflux Corp., 7300 West Lawrence Avenue, Chicago 31, Ill., now offers a portable, spray-on fluorescent penetrant inspection kit for locating cracks, pores, and leaks in non-magnetic materials. This innovation combines the most sensitive of the fluorescent Zyglo penetrants with the convenience of pressurized spray cans. Included in the kits steel carrying case are pressurized spray cans with cleaner, penetrant, and developer; a 100 watt high intensity black light; cleaning cloths; wire brush; and detailed instructions. In testing with Zyglo, penetrant is sprayed on the surface of the part to be tested, and time is allowed for capillary action to draw the penetrant into any crack or porosity. Cleaner is then used to remove penerant from the surface. By applying a thin film of spray-on-developer,



the fluorescent penetrant is drawn to the surface from any crack or pore. The portable, high intensity black light locates every defect as a glowing fluorescent indication. The kit may be used for maintenance work, overall tests, (especially of non-magnetic parts) or for small volume in-production testing of castings, forgings, machine parts, weldments, and carbide tools. Any thin walled casing, weld, or tank which must be leak proof in its final assembly may be inspected for leaks at any stage in its manufacture.

* * *

The Webber Gage Co., 12912 Triskett Road, Cleveland 11, Ohio announce the addition of a complete line of square type gage blocks both in chrome carbide and in standard steel. The blocks are designed for complete interchangeability with all other square gage blocks, the blocks are 0.950 inches square with tie rod holes ¼ inch in diameter. The blocks are produced in complete ranges of sizes, and are available as individual or replacement blocks or in sets of 34, 36, 81, 84, 85 and 88 blocks, to standard A or B accuracies. Square chrome carbide wear blocks in 0.050 and 0.100 inch sizes, all standard accessories including tie rods, half round jaws, straight jaws, scriber points and triangular base blocks are also furnished.

* * *

The George Scherr Co., Inc., 200 Lafayette Street, New York 12, N. Y. has introduced the new Tumico Optic Vernier Height Gage. The prob-

lem of quickly and accurately reading fractions of 1/10000 inches has been solved by employing glass scale and glass vernier scale, on which scale and vernier lines are machine divided and etched to be read from the rear of the gage. An inwardly curved chrome reflector behind the glass scale diffuses light and shows scale, vernier lines and numbers on glass scale in sharp relief, eliminating such aids as magnifiers and auxiliary lights. The double length vernier is 2.450 inches long and adjustable. Accuracy of the setting may be checked with standard gage blocks. A new designed H-beam is used for superior strength and exceptional rigidity, preventing sway and vibration. The sliding head moves through its entire range by the action of a full-length, large diameter screw inside the H-beam providing 100 to 1 ratio fine adjustment. A single push button frees the sliding head for approximate setting. Lock knobs, on both sides of the sliding head provide for quarter turn solid lock of head to H-beam. One of the chief advantages is the location of the fine adjustment screw on the base, which eliminates a tendency toward tilting and unintentional moving of the gage which occurs in conventional height gages having the fine adjustment screw or micrometer adjustment on the sliding head. Gages 36 inch and larger are provided with additional fine adjustment knob on the top of the H-beam, for making fine adjustments standing up. Available sizes are 18, 24, 36, 48, 60, 72 and 84 inches. Prices start at $310.00.

★ ★ ★

Dit-Mco, Inc., 911 Broadway, Kansas City 5, Mo., has recently marketed a new Circuit Analyzer, Model 2000. This new analyzer is designed for field or production line tests of complete electrical systems involving complex, multiple interconnected circuitry, and tests up to 2,000 circuits automatically. The tester accurately and automatically tests one circuit against all other circuits in the system for continuity and short circuit or insulation type flaws, simultaneously, at a rate of one-tenth second per circuit. Test quality may be established to pre-determine values and external resistive devices can be automatically energized in any test position by proper programming. Test circuit revisions are quickly made on removable patch cord program boards by changing jumper cords with phone-jack tips. The Circuit-Analyzer never requires internal modification from one job to another and will never become obsolete. Dit-Mco's exclusive Matrix Chart defines error location and type and its operational efficiency and simplicity virtually eliminate human error. Modular section construction simplifies servicing and expansion, and provides greater shock and moisture resistance. The entire unit is housed in one cabinet which is mounted on rubber wheels for mobility. Standard tele-type components give extra long life and require minimum maintenance.

★ ★ ★

The Exact Weight Scale Co., of Columbus, Ohio has announced the new Basic Weight Classifier for quality control in process of products and packages by weight. The Basic Weight Classifier is also in use for production line inspection of metal assemblies for missing parts and open or closed packages for correct contents. Adjustable crystal photocells are mounted adjacent to the visual dial on the Exact Weight Shadograph Scale used in the Basic Weight Classifier is offered in 34 different models. Capacities range from 2000 milligrams up to 100 pounds. Commodity receptacles and platters are available to accommodate any size or shape product. The shadoedge weight indication on an illuminated scale dial provides visual reference and eliminates parallax readings. Two or more photocells can be mounted across the optical dial of the Shadograph Scale to provide any number of classifications from 2 to 128. The larger number of classifications are accomplished with a projected binary coded "gray" scale dial mounted on the Shadograph weighing mechanism. The photocells are mounted inside the standard Shadograph housing, and increase the accuracy two times better than the advertised visible sensitivity of the Shadograph Scale. A controller is used with the Shadograph Scale to operate relays to open and close circuits when the weight is reached. This controller may be used to actuate automatic transfer mechanisms, operate counters, visual signal lights, or alarm signals and may also be used to actuate permanent visual chart recorders for statistical quality control of processes.

★ ★ ★

New Literature

Jones & Lamson Machine Co., Springfield, Vt., have published catalog #57 which gives general information about their entire line of machine tools, optical comparators and accessories.

A new bulletin describing the four Kentrall Combination Hardness Testers has been announced by the Torsion Balance Co., Clifton, N.J. Each of these Hardness Testers makes both regular and superficial Rockwell Tests and costs about the same as "single-function" testers.

HW 8-57 available from Information Service of the Jarrel-Ash Co., 26 Farwell Street, Newtonville 60, Mass. describes a variety of precision quality control instruments for opti-

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Milwaukee 3, Wis.

cal products, and lists detailed catalogs available for each instrument.

The Jones and Lamson Machine Co., Springfield, have recently published catalog 5700 covering their entire line of optical comparators and accessory equipment. This 37 page catalog completely describes all models of comparators plus charts and accessories which are obtainable from the manufacturer.

B & K Manufacturing Co., 3726 North Southport Avenue, Chicago 13, Ill., has issued a new bulletin 100 which describes their Shorted Turns Indicator. This bulletin illustrates and describes the improved performance of the B & K Model 100, and explains how the indicator speedily tests coils for shorts and open circuits in one simple operation before assembly.

The new 6-page bulletin T-57, featuring the thermotest portable potentiometer for measuring temperatures and voltages, is offered by the manufacturer, Technique Associates, Inc., P. O. Box 91, Indianapolis 6, Ind. The Thermotest is an instrument with interchangeable direct-reading scales and automatic compensation for measuring temperatures from −200°F to +600°F, and voltages to 20.1 millivolts.

The Electro-Probe Electronic Test Indicator, a completely portable dimensional test instrument and the Sure-Set, an electronic table positioning device for universal grinders, are fully described in a new 4-page brochure recently issued by Federal Products Corp., 1144 Eddy Street, Providence 1, R. I.

Edmund Scientific Co., Barrington, N. J., has just published an 80-page catalog of optical aids for industry. Over 1,000 optical items are described including a wide variety of quality control tools and optical bargains.

"Simple Methods for Analyzing Plating Solutions," a 36-page two-color booklet is being re-offered by Hanson-Van Winkle-Munning Co., Matawan, N. J. in response to popular demand. This bulletin is prefaced by a discussion of analytical principles, use of apparatus and methods for sampling a plating solution. It then outlines in detail the necessary steps involved in 28 analytical methods for testing nickel, copper, silver and other metal finishing solutions.

Magnetic Analysis Corp., 42-44 Twelfth St., Long Island City 1, N. Y. is offering a new bulletin No. 90 on its equipment for the non-destructive testing of ferromagnetic wire rope. Use of this equipment permits detection, location and evaluation of flaws without hindering the production process. Typical flaws detected are broken wires, protruding wires, severe internal defects, defective welds, cross-over wires, missing wires and wire rope deformations.

A new 4-page bulletin, LT-6, telling how the Profilometer increases tool life through accurate measurement of tool finish has been issued by Micrometrical Mfg. Co., 345 So. Main Street, Ann Arbor, Mich. Longer tool life and improbed surface finishes are possible through proper tool sharpening. Included in this bulletin is a case history report from a well known manufacturer of electrical equipment telling how tool life was increased 95 percent.

SUPERVISOR'S CIRCLE

PAUL A. ROBERT, *Editor*

Precision Products Co. of Cincinnati, Box 130, Norwood 12, Ohio

SPECIAL INSPECTION TESTS

determine the spring-making properties of pre-tempered steel strip

WILLIAM R. JOHNSON

Research Center, Associated Spring Corporation, Bristol, Conn.

EDITOR'S COMMENTS

The Inspection Department is in a position to assist Engineering with their flat spring problems by making statistical analyses of proposed designs by establishing proper specifications and controls and by doing scientific trouble-shooting when problems arise.

The tests suggested in this article are the recommendation of an expert in spring manufacture.

The author of this article will be very happy to answer any questions you might have regarding the testing of pretempered steel strip.

The length of this article made it necessary to publish it in two parts. The balance will appear in the March issue of *Industrial Quality Control.*

Hardened or pretempered spring steel calls for a variety of inspection tests to make sure that the quality and the spring-making properties of the incoming material will be exactly suited to the specialized requirements of the customer.

From its long experience in making flat springs, the Wallace Barnes division of Associated Spring Corp. has devised a number of special tests to determine the particular properties of tempered spring steel which make it well suited to spring fabrication.

Many of these specialized tests are used not only for quality control inspection but also for research studies aimed at product improvement.

Pretempered spring steel is usually required to meet a hardness specification, which is generally measured by means of one of the standard hardness testing devices, with a scale appropriate to the thickness of the steel. But *hardness* frequently indicates only part of the steel's pertinent properties. True, it is rapidly and inexpensively measured, and the test gives reasonably uniform and consistently reproducible indications. But very seldom does the hardness test alone give a direct and sufficient index of the qualifications of the material.

Hence, the need for additional, special tests such as those described below. These are designed to measure other properties of the material that will provide direct and unqualified answers to a customer's questions, such as: "How much load will it carry without permanent set?", "How many cycles will it run without breaking?" and "What is the smallest radius we can form?"

The Set Point Test

A measure of spring performance has been devised which is much more universally applicable. This may be described as "the set point test." It is important to many customers to know what load can be applied to a part blanked from tempered spring steel with no permanent change in dimensions after the load has been removed. This stress level might be called the elastic limit in bending of the steel, or the set point.

The set point test is very sensitive to the condition of the surface layers of the steel, because it is applied by bending the stock, rather than by applying tension. Basically, the set point test consists of bending or deflecting a specimen of a given length around an arbor of known diameter and measuring the amount of permanent set. The stress level in the material is computed by the simple formula:

$$S = \frac{Et}{D}$$

where

S = the stress in psi.

E = Young's modulus of elasticity

t = the thickness of the stock, in inches

D = the diameter of the arbor, in inches

In practice, a specimen two inches long is forced into close contact with a curved arbor, deflected around it, and then released. The height of the arc after the pressure has been released (i.e., the amount of permanent set) is then measured. The deflection of the specimen is then repeated with arbors of successively smaller diameter. A plot is made of the arc height (permanent set) against the diameter of the arbor for each deflection given.

The set point is arbitrarily taken as the point where the arc height after release is equal to 2 percent of the deflection under load (see Fig. 1).

The arc height is measured by a modified micrometer in which the fixed anvil has been extended to accommodate the 2-inch long specimen (see Fig. 1). The bowed specimen is held in place by the two anvils of the micrometer, and the movable anvil retracted until the specimen drops by gravity from between the two. The reading is taken at this moment. Any bow in the original specimen before the deflection was applied will automatically be allowed for by the fact that the arc height is measured by the difference in the micrometer reading between that taken with the original specimen and that taken with the deflected one.

(Editorial note: Part II of this article will appear in the March issue of INDUSTRIAL QUALITY CONTROL.)

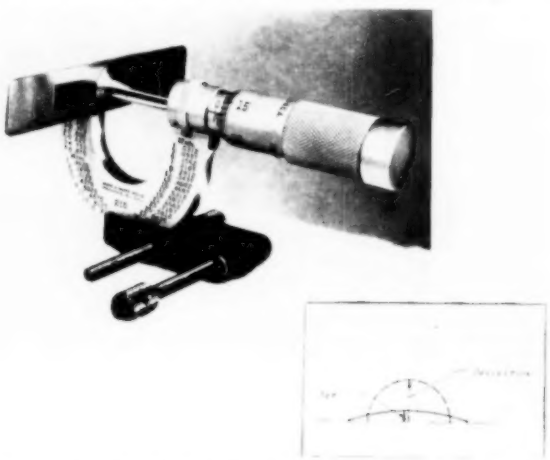

Figure 1—For the set point test, this modified micrometer measures the arc height in the 2-inch long specimen of spring steel strip, before and after deflection.

QUALITY - RELIABILITY - REPUTATION are words that take on a new meaning for employees when used in the colorful and compelling

ELLIOTT HI-VISION PROGRAM

(See page 37)

section briefs

ALBANY . . . At the December meeting, Frank C. McLaughlin, General Electric's Manufacturing Services Division, presented ideas for "Quality planning for good incoming material control." Mr. McLaughlin developed the cycle of planning, measuring, and analyzing for material control.

The problem session was handled by Maynard Wells, QC manager at GE, Waterford, and Mel Lindquist, QC manager at GE Motor Division, Schenectady. The group considered methods of setting raw material specifications, control of raw materials, and customer certifications.

ALLENTOWN-BETHLEHEM . . . Spirits not dampened by the snowstorm, the section enjoyed one of its most interesting and informative sessions as Robert Schin of Western Electric Co. discussed many shop applications of QC. Mr. Schin is the section's district representative and is serving on the committee for establishing professional status for the various membership grades of ASQC.

BALTIMORE . . . An excellent panel discussion around the central theme "Quality control poses problems for management—what would you do?" featured the December meeting. The top management panel included Messrs. E. R. Harrall, Bendix Friez, E. M. Schrock, American Radiator and Standard Sanitary Corp., A. L. Lambert, The Martin Co., G. J. Hurwitz, Army Chemical Center, with C. I. Rice, Bendix Aviation, as moderator. Although inclement Baltimore weather adversely affected attendance, the hardy audience enthusiastically appreciated the program.

To avoid conflict with the Middle Atlantic Conference (New York, Feb. 28-Mar. 1) no meeting is scheduled in February. Special publicity will be directed to members and prospects urging attendance at this important meeting.

BATTLE CREEK-KALAMAZOO . . . The December meeting was held at the Post Cereals Club House. Robert Muir, chief inspector for Lundberg Screw Products Co., spoke on the subject "The supplier and quality control."

The Mar. 7 meeting will be held at Western Michigan University, Kalamazoo. The speaker for the evening will be Harmon Bayer who has been extremely active in both the national and Michigan development of ASQC. He has authored numerous articles and is considered one of the foremost authors in the QC field. His subject for the evening will be "Organizing an effective quality control program that pays."

BINGHAMTON . . . The Binghamton, Corning-Elmira, Danville-Sunbury, Allentown-Bethlehem, Syracuse, and Scranton-Wilkes-Barre sections are working together in preparing for the Mar. 15 all-day quality control clinic. The speakers and topics are: R. M. Jacobs, RCA Corp., "Low cost mutiple sampling;" Bill Warwick, GE Corp., "Total quality control;" and Dr. Sikorsky and Capt. Reigare, Bureau of Ordnance, "Value of engineering."

BUFFALO . . . The section united with the St. Catherines section in a joint meeting at Thompson Products, St. Catherines. Sig Zobel, former professor of QC at the University of Buffalo and now at Pratt & Letchworth, spoke to the group on "Foundry applications of quality control."

Loblaw, Inc., one of the leading supermarket chains of the U.S. with headquarters in Buffalo, has been featuring its quality control activities on weekly TV programs during the past three months.

BUZZARDS BAY . . . Richard J. Callahan, chief of the quality engineering department, U. S. Navy Central Torpedo Office, Newport, discussed "Government acceptance and sampling procedures" at the December meeting.

Certificates were awarded at the meeting to six members who completed the basic quality control course which the section sponsored during the fall.

CHARLESTON . . . In collaboration with the Chemical Division, the section has arranged a three day course in "Response surface methods of experimentation" on Feb. 26-28. The course will be presented by Dr. Stuart Hunter of Princeton University. More information may be obtained by writing to B. H. Carpenter, chairman, education committee, 838 Monmouth Street, Saint Albans.

CINCINNATI . . . In spite of almost zero weather, we had very good attendance at the December meeting. Dr. Leonard W. Swanson's subject was "Operations research in business and industry."

Bill Eilrich and Bill Barker presented a QC demonstration and interview on WLW-T, Dec. 29, to publicize the section's January conference.

On Mar. 19, William R. Davison of Phillips Petroleum Co. will speak on "Some problems related to setting an AQL."

CLEVELAND . . . At our December meeting, Western Electric's Miss Bonnie B. Small presented many fresh ideas to use for a training program in the technique and usage of an overall quality control function.

A drive to increase membership has begun with special invitations by mail to all section members to help.

COLUMBUS . . . Dr. Paul S. Olmstead will be the principal speaker at the March meeting. In his talk, Dr. Olmstead will discuss the use of operations research as a useful QC technique. The need for good QC data in building a research model to solve specific problems will be stressed.

Dr. Olmstead is a fellow of ASQC and has served the Society on numerous committees.

CORNING-ELMIRA . . . The section had a fine turnout for an informal December meeting. A very interesting plant tour of Westinghouse-Horseheads was followed by a neat dinner at the plant and a short film on process controls. A note of thanks is due to the Westinghouse personnel who engineered the job.

CUMBERLAND . . . Dr. J. H. Davidson of the General Electric Co. spoke on "Design of experiments—how to get results" at the December meeting. Dr. Davidson is the manager of the statistical methods department of the GE General Engineering Laboratory, Schenectady.

DALLAS-FORT WORTH . . . Dr. Carl E. Marshall, Oklahoma State University, gave a very enlightening talk at the De-

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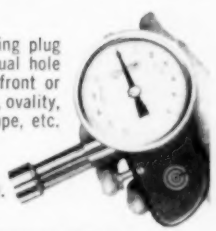

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REQUEST BULLETIN 50

SECTION CALENDAR (FEBRUARY 20—MARCH 31)

SECTION	DATE	PLACE	TIME	SUBJECT	SPEAKER
Albany	Mar. 13	University Club	4:30 pm	Market Research	Dr. T. A. Brown
Baltimore	Mar. 11	Baltimore Memorial Stadium	8:00	Project Engineering and Quality Control	Norman C. Krause, Army Chemical Center
Battle Creek-Kalamazoo	Mar. 7	Western Michigan University	8:00	Organizing an Effective Quality Control Program that Pays	Harmon S. Bayer, Consultant
Binghamton	Mar. 15	YMCA, Scranton	——	All-Day Quality Control Clinic	——
Buffalo	Mar. 31	Chevrolet Motors	——	Plant Tour	——
Buzzards Bay	Mar. 11	Continental Screw Co., New Bedford	8:00	Quality Control in the Manufacture of Aluminum Foil	O. H. Bishop, Reynolds Metals Co.
Charleston	Feb. 20	South Charleston Recreation Center	8:00	Design of Experiments	B. J. Carpenter, Union Carbide and Carbon Chemical Corp.
	Mar. 20	South Charleston Recreation Center	8:00	Distributor's Interest in Quality Control	R. W. Peach, Sears Roebuck and Co.
Cincinnati	Mar. 19	Engineering Society Building	8:00	Some Problems Related to Setting an AQL	William R. Davison, Phillips Petroleum Co.
Cleveland	Mar. 7	Cleveland Engineering Society	8:00	The Statistician in Relation to Quality Control	Dr. Cecil C. Craig, University of Michigan
Columbus	Mar. 19	North American Aviation	8:00	Operations Research	Dr. Paul S. Olmstead, Bell Telephone Laboratories, Inc.
Corning-Elmira	Mar. 11	Corning	8:00	Attribute Sampling of Parts from Continuous Production Lines	Cuyler J. Hawkes, Eastman Kodak Co.
Cumberland	Mar. 6	Fort Cumberland Hotel	6:30	Business Applications of Statistical Methods	R. B. Shartle, The Standard Register Co.
Dallas-Fort Worth	Feb. 25	Engineering Bldg., Arlington State	7:00	Multiple Sampling Plans	L. C. Craig, Texas Instruments, Inc.
	Mar. 4	Engineering Bldg., Arlington State	7:00	Quality Control Organization and Problem Session	Panel of five speakers
	Mar. 13	Engineering Bldg., Arlington State	8:00	General Quality Control	Leon Bass, General Electric Co.
	Mar. 15	T. C. U.	——	3rd Annual Quality Control Symposium	Various authorities of national standing
Dayton	Feb. 20	Brown Derby Restaurant	6:30	Clues to Effective Process Control Investigation	Richard S. Bingham, The Carborundum Co.
	Mar. 1	Biltmore Hotel	——	All-Day Conference	——
Evansville-Owensboro	Feb. 20	Evansville College	7:30	Who is Responsible for Quality	L. A. Seder, Consultant
Greater Muskegon	Mar. 12	Mona Lake Boat Club	6:30	Panel Discussion	——
Hamilton	Mar. 13	Westinghouse Auditorium, West Plant	8:00	Quality Control in the Steel Industry	Henry J. Becker, American Steel and Wire Div., U. S. Steel Corp.
Hamilton-Middletown	Mar. 12	——	6:30	Whirlpool and Quality Control	E. W. Simms, Whirlpool Corp.
Hartford	Mar. 18	Club Alden	8:30	Industrial Engineering Applications of Statistical Quality Control	James Dolby, General Electric Co.
Lansdale	Mar. 13	Eagles Auditorium	7:30	Quality Control Applications to Indian Industry	Dr. Ellis R. Ott, Rutgers University
Los Angeles	Mar. 12	Rodger Young Auditorium	6:00	Management Applications of Statistical Quality Control	——
Louisville	Mar. 10	General Electric, Appliance Park, Bldg. 4	8:00	Statistical Quality Control Applications for Fabricating Steel	Guy Campbell, Turnstead Div., GMC
Memphis	Mar. 21	Memphis State University	7:30	Statistical Quality Control in Engineering and Research Development	Dr. Paul S. Olmstead, Bell Telephone Laboratories, Inc.
Michigan	Mar. 15	University of Michigan	——	National Automotive Division All-Day Conference	——
Mid-Hudson	Mar. 4	Anchor Inn, Poughkeepsie	7:00	Vendor Quality Rating	H. G. Harding, IBM Corp.
Milwaukee	Mar. 14	Wisconsin Hotel	——	5th Industrial All-Day Clinic	——
Minnesota	Mar. 10	——	——	Gaging	W. W. Jenks, Pratt & Whitney Co., Inc.
Omaha-Lincoln	Mar. 14	Omaha	7:00	——	——
Philadelphia	Feb. 20	Germantown Cricket Club	6:30	Pneumatic Gaging	D. Kirk, Moore Products Co.
	Mar. 20	Germantown Cricket Club	6:30	Preventive Maintenance Theory	R. Drenick, Bell Telephone Laboratories, Inc.
Pittsfield	Mar. 6	——	——	Basic Concepts—How to Organize and Operate an SQC Program	Dr. Ellis R. Ott, Rutgers University
Rhode Island	Mar. 20	Providence Engineering Society Bldg.	——	——	James A. Mitchell, Tennessee Eastman Co.
Rochester	Mar. 4	Chamber of Commerce	6:15	Automatic Gaging	R. C. Derbyshire
	Mar. 18	Chamber of Commerce	6:15	Further Observations on Initiating a Quality Group in an Existing Organization	Major General (U. S. Army, Retired) Leslie E. Simon, The Carobundum Co.
St. Louis	Feb. 21	Golden Fried Chicken Loaf Restaurant	6:00	Analysis of Variance as Applied to Wire Mill Applications	Henry J. Becker, American Steel and Wire Div., U. S. Steel Corp.
San Antonio	Mar. 11	——	8:00	Management Meeting	——
San Francisco Bay Area	Mar. 10	Garden Room, San Mateo	6:30	Aspects of Quality Control in the Electronic Industry	Gene Brown, Lenkurt Electric
				Clinic—Process Control	Stan Meyer, Ampex Corp.
Scranton-Wilkes-Barre	Mar. 15	YMCA, Scranton	9:00 am	All-Day Quality Control Clinic	——
Seattle	Mar. 11	Benjamin Franklin Hotel	7:30 pm	——	Frank H. Squires, Topp Industries
South Bend-Mishawaka	Feb. 20	Eagles Clubroom, South Bend	6:30	A Brief Case for Business	Frank G. Kelley, Thiessen Clemans Co.
	Mar. 20	Bendix Legion Post #284, South Bend	7:30	Vendor Customer Relations	Sydney F. Knapp, U. S. Rubber Co.
South Texas	Mar. 12	Ben Milam Hotel, Houston	7:00	Management Night—Management and Quality Control	Leon Bass, General Electric Co.
Southern Connecticut	Mar. 12	Bridgeport	8:00	Panel Discussion—Quality Control Problems	Panel of three speakers
State Univ. of Iowa	Feb. 27-28	Blackhawk Hotel, Davenport	——	Technical Sessions; Plant Tour, Red Jacket Mfg. Co.	Prof. Gayle McElrath, University of Minnesota (Arrangements by David A. Hettel)
Toledo	Mar. 6	Chevrolet Plant	——	Plant Tour	——
	Mar. 27	Macomber High School	8:00	The Conquest of Near Space	Willy Ley
Toronto	Feb. 26	Sign of the Steer	10:00 am	Management Conference on Statistical Quality Control	W. M. Bristol III, Bristol Meyers Products Division
	Mar. 8	Hart House, University of Toronto	8:30	Statistical Quality Control Conference and Banquet	R. W. Todgham, Chrysler Corp. of Canada Ltd.
	Mar. 19	Sign of the Steer	6:00 pm	Automation and Industry's Obligation to Man	S. Barkin, Textile Workers Union of America
Washington	Mar. 26	——	——	Strategy in Research	W. P. Drews, Esso Research and Engineering Co.
Winnebago	Mar. 10	Elk's Club, Appleton	——	——	——
Worcester	Feb. 20	Worcester Polytechnic Institute	7:00	The Challenge of Reliability	W. A. MacCrehan, Bendix Radio Division
Youngstown	Mar. 6	——	——	A Case Study on Operation Research	Leonard Arnoff, Case Institute of Technology

Automotive Division Conference

The 1st National Conference of the Automotive Division of ASQC will be held on Saturday, Mar. 15, at the Rackham Bldg., University of Michigan, Ann Arbor.

The purpose of the conference is to demonstrate the integral responsibilities for product quality that each function in a plant or company has. We are all aware that the quality of a product is the sum total of each plant activity—design engineering, process or tool engineering, purchasing, inspection, production, and service—properly performing in accordance with its quality job. In accordance with this purpose, the theme of this conference is "Automotive quality from plan to product."

The speakers for this conference are: W. M. Daley, Ternstedt Div., GMC; L. N. Bress, General Electric Co.; C. J. Demrick, Plymouth Div., Chrysler Corp.; M. M. Dean, Ford Motor Co.; J. A. Parker, A O. Smith Corp.; and D. N. Smith, Jones and Lamson Machine Co.

Program and registration information is available by writing to Theodore W. Miller, Quality Control Engineer, Detroit Transmission Division, GMC, Ypsilanti, Mich.

cember meeting relative to the need for additional required statistical training in our colleges and universities.

Leon Bass, manager of quality control at the Jet Engine Department of General Electric Co., will be the speaker at our Mar. 13 meeting. Mr. Bass will also be one of the featured speakers at the third annual quality control symposium, Mar. 15, at Dan Rogers Hall, Texas Christian University. This symposium, sponsored by the section, is open to anyone interested in the field of QC.

DAYTON . . . Thirty-three persons attended the December meeting which was "Ladies Nite." Dr. Gayle McElrath presented an enjoyable talk.

On Mar. 1 the 3rd annual all-day conference will be held at the Dayton-Biltmore Hotel. The theme of the conference is "Cost of quality."

EVANSVILLE-OWENSBORO . . . E. H. Robinson, director of quality control for Johnson and Johnson, was the speaker at the Dec. 10 meeting.

L. A. Seder, a consultant and fellow in ASQC, will be the speaker at the Feb. 20 meeting at Evansville College. His subject will be "Who is responsible for quality?"

GREATER MUSKEGON . . . Leon Harrington, chief inspector and director of QC at King-Seeley Corp., gave an interesting talk on the company's incoming acceptance plan. The presentation was accompanied by slides showing QC plant methods and formulas used. Mr. Harrington is very active in state and national QC organizations.

The section will hold its annual fish fry at the Mona Lake Boat Club on Mar. 12. A panel discussion on QC by members of industry will complete the program. Panel members are: Emil Olson, Anaconda Wire; L. Brunner, General Electric Corp.; and Frank Dzielski, Continental Motors.

HAMILTON . . . A very enlightening address on the subject "Improved quality control through quality audit" was delivered by W/C G. G. Waterman, RCAF, Malton, at our December meeting.

HAMILTON-MIDDLETOWN . . . The section visited the Sorg Paper Co., Middletown. The visit was of much interest to all who attended.

E. W. Simms will discuss "Whirlpool and quality control" at the Mar. 12 meeting. Dinner will be served at 6:30 pm, compliments of the Whirlpool Corp. The meeting will follow at 8. Mr. Simms' experience and wide background insure a viewpoint toward quality control that will be challenging and interesting to all.

HARRISBURG . . . Sherman Babcok of RCA, Harrison, N. J. was the speaker at our October meeting. Mr. Harrison presented "Acceptance sampling by lots by the median, quasi-range method." The first meeting of the year was highly successful and well attended.

The November meeting was held at Thompson Products, Inc. Dan Meckley of the Borg-Warner Corp., York, Pa., spoke on the subject "What is an inspector?" The meeting also included a plant tour which was highly entertaining. Oh yes, the dinner was free—compliments of Thompson Products—and the turnout was terrific.

Weather conditions were the cause of the December meeting cancellation.

Hostetter's, Mt. Joy, Pa., was the site of the January meeting. The section was fortunate in having Frank Caplan, Jr. as the featured speaker. Mr. Caplan, Westinghouse Electric Corp., Cheswick, Pa., spoke on the subject of "Process control in a job shop." The speech was informative and very enlightening and took us through the installation of a quality control program in a short run shop.

Mike O'Hanlon of Amp, Inc., Automatic Machine Division is instructing an SQC course at Dickinson College, Carlisle, Pa. Twenty-seven students are enrolled. Plans are underway to start another SQC course in Harrisburg in the near future.

HARTFORD . . . To stimulate the social side of the Society, a Christmas dance was substituted for the regular December meeting. Prizes, entertainment, and the music of Bob Kay's orchestra made the evening a pleasant one for members and their wives. The food served would sate a royal palate.

LANSDALE . . . The December meeting was a dinner meeting and a plant tour of Leeds and Northrup's new plant at North Wales. The dinner was served in the large, modern dining room at the plant. Dinner was followed by a guided tour of the facilities of the plant.

The Mar. 13 meeting will be a general talk by Dr. Ellis Ott on his recent four month assignment in the interest of QC in India. His topic will be "Quality control applications in Indian industry" which will be illustrated with color

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Middle Atlantic Conference

The Middle Atlantic Conference of ASQC will be held at the Hotel Statler, New York City, on Friday and Saturday, Feb. 28-Mar. 1.

Some of the most competent and best informed speakers will be on hand to discuss subjects that will expand the horizons, promote the interest, and advance the thinking of all quality control directors.

The tentative program schedules five sessions each in both morning and afternoon of the two days of the conference.

A sampling of the program includes subjects such as "Quality rating of manufactured products" and the speaker on this subject will be Harold Dodge, quality control engineer, Bell Telephone Laboratories. Enoch B. Ferrell, switching research engineer of Bell Telephone Laboratories, will present "Control charts for log-normal universes." "Reliability—its meaning and measurement" is the subject of the session for which August B. Mundel is moderator. Mr. Mundel is director of the quality control and inspection division of the Sonotone Corp. As one of the speakers at this session, Miss Vida Grace Hildyard, Remington-Rand Univac, will present "Component vs. system reliability."

These are some of the 60 speakers and moderators who will be a part of the interesting 2-day program.

Luncheon speakers on the two days of the conference will be V. Elliott Felt, Jr., manager, Vanguard Operations, The Martin Co., who can unveil the mysteries of a missile without disclosing classified information, and Dr. Kenneth McFarland, educational consultant and engineer, General Motors Corp., who has an interesting message for all those attending the meetings.

For a copy of the program or registration information write to F. W. Kroll, Jr., Program Chairman, Esso Standard Oil Co., Box 22?, Linden, N. J.

slides. This will be followed by several films entitled "Automation today" and "Firebird II." We are fortunate in obtaining Dr. Ott for this meeting in that this will be his first talk upon returning from India. An invitation to attend will be sent to the Allentown-Bethlehem and Philadelphia sections. We don't believe in monopolizing in a good thing.

LOS ANGELES . . . David Cowan very admirably explained the "Span Plan" with easy to understand geometric analogies and single factor analysis of variance.

LOUISVILLE . . . The plant tour and luncheon in December at the Brown and Williamson Tobacco Co. were well attended with 52 members present.

The educational committee announced the start of another course in basic quality control. This is the third such course conducted by the section during the 1957-58 season.

MEMPHIS . . . The section has established a library containing literature and reference books on SQC. The library is located at Plough, Inc., and is open to all interested persons by contacting E. Dudley Robinson.

The Mar. 21 meeting will be held at Memphis State University with Dr. Paul S. Olmstead of Bell Telephone Laboratories speaking on the topic "Statistical quality control in engineering and research development." Dr. Olmstead is a member of the editorial board of "Industrial Quality Control."

MICHIGAN . . . The first national conference of the Automotive Division of ASQC will be held on Saturday, Mar. 15, at the Rackham Building, University of Michigan, Ann Arbor.

The purpose of the conference is to demonstrate the integral responsibility for the quality of a product that each function in a plant or company has. In accordance with this purpose the theme of this conference is "Automotive quality from plant to product."

An excellent program, with top-flight executive speakers promises to more than satisfy for the purpose of the conference.

MID-HUDSON . . . George R. Scheel, assistant director of quality control, Sonotone Corp., was the guest speaker at the December meeting. His topic was "Quality control in hearing aid manufacture" which was followed by a very informative question and answer discussion.

The Mar. 4 meeting will be held at the Anchor Inn, Poughkeepsie when H. G. Harding will talk on "Vendor quality rating."

MILWAUKEE . . . Marquette University's Student Union was the meeting place for the annual "ladies nite" held during December. Although the cold weather limited the attendance, those who came had a very enjoyable evening. Prof. Gayle McElrath from the University of Minnesota, spoke on "Quality control—woman's oldest weapon." Thoroughly entertaining, the talk climaxed a buffet supper and a highly successful cocktail hour.

Plans were being finalized for the program for the 5th industrial all-day clinic to be held at the Wisconsin Hotel on Mar. 14. Approximately 12 sessions will be presented including such subjects as brewing applications, administrative applications, metal trades, and pharmaceuticals.

MINNESOTA . . . The topic for the evening of Monday, Mar. 10, will be "Gaging." The speaker will be W. W. Jenks of Pratt and Whitney Co., Inc.

OMAHA-LINCOLN . . . Ladies night was observed by the section during December. Twenty-one members and guests enjoyed dinner and the film, "The story of Irish linen."

PHILADELPHIA . . . A gala Christmas party was held at the Germantown Cricket Club. The singing of carols and the awarding of many fine prizes made the evening one that will be remembered by section members. The committee in charge of the affair did a wonderful job.

Two excellent meetings are scheduled for February and March. On Feb. 20, D. Kirk of Moore products Co. will speak on "Pneumatic gaging and its application to automation and quality control." The talk should be of special interest to those in the metal working field. Then on Mar. 20, R. Drenick of Bell Telephone Laboratories will speak on "Preventive maintenance theory."

PITTSFIELD . . . An excellent dual session was held during December. Robert Sheehan of Sprague Electric Co. discussed the "Analysis of life test data" and Leonard Kroll of Peter J. Schweitzer, Inc., showed slides on the "Economics of life testing."

Despite the bitter cold, a large number of members toured the Sprague Electric Plant in North Adams in January. Following dinner, a movie was shown on QC in the field of electronics.

The second afternoon-evening session will be held on Thursday, Mar. 6. Dr. Ellis R. Ott of Rutgers University will present a paper on "Basic concepts—how to organize and operate an SQC program." A large attendance is expected from local management groups.

RHODE ISLAND . . . William A. MacCrehan, Bendix Radio Division, spoke on "The challenge of Reliability" at the December meeting. He discussed the points to look for when reliability is part of the specification.

In March, James A. Mitchell, development and control superintendent of Tennessee Eastman Co., will be our featured speaker.

ROCHESTER . . . Three fine programs were held during the months of November and December. The speakers and their topics were: John A. Harrington, Do-ALL Co., "Principles and techniques of precision measurement;" Dr. Clifford Hildreth, Michigan State University, "Programming and some related statistical problems;" and Dr. Fred A. Beeler, Western Michigan College, scored a bulls-eye with "Let's quit using an elephant gun to shoot flies."

ST. LOUIS . . . For our meeting scheduled for Mar. 21, the section has arranaged for a plant tour of the American Can Co., 3200 S. Kings Highway.

SAN ANTONIO . . . The December meeting was held at the Hilton Hotel. Dr. Carl Marshall, Oklahoma State University, addressed the group on "Teaching of statistics and training of statisticians." Dr. Marshall's presentation was very interesting and most informative to all.

SAN FRANCISCO BAY AREA . . . Friden, Inc., San Leandro, recently was host to the section. R. E. McKennan, assistant chief inspector, addressed the dinner session of the evening's program on Friden's QC applications after which a plant tour was conducted.

The Mar. 10 meeting will be a dinner-clinic session. Gene Brown, Lenkurt Electric, will speak on the "Aspects of QC in the electronic industry" and Stan Meyer will address the clinic session on process control.

SCRANTON-WILKES-BARRE . . . The section will hold a joint quality control clinic at the YWCA, Scranton, on Mar. 15.

The other participating sections are Allentown-Bethlehem, Binghamton, Corning-Elmira, Danville-Sunbury, and Syracuse.

Tentative speakers include Captain Reigart and Mr. Sikorsky from the Bureau of Ordnance, Richard Jacobs of RCA, William Warick of General Electric, Dr. Ellis Ott of Rutgers University, Professor Paul Clifford of Montclair State Teachers College, and Miss Bonnie B. Small of Western Electric Co.

The program begins at 9 am continuing to 5:30 pm with an excellent dinner to be served at noon.

An all out effort is being conducted by the participating sections for a most successful and enjoyable affair.

SEATTLE . . . At the last meeting, a five member panel, lead by Prof. Grant I. Butterbaugh, discussed the potentials of quality control in administrative work.

SOUTH BEND-MISHAWAKA . . . Ladies of the members will be the featured attraction when the section holds its annual ladies night meeting on Feb. 20 at 6:30 pm in the FOE Clubroom in South Bend.

Fun, humor, and good fellowship will be the theme for the entire evening.

We were fortunate in obtaining Frank G. Kelley, public relations director for the Thiessen-Clemans Co. of Benton Harbor, Mich., as the featured speaker. Mr. Kelley's talk will be "A brief case for business" and he always comes up with a hard hitting talk filled with humor and fun that we know the ladies will enjoy.

SOUTH TEXAS . . . The section met on Dec. 11 to hear a timely address by Dr. Carl E. Marshall on "The teaching of statistics and the training of statisticians for industrial employment." Dr. Marshall is professor of statistics at Oklahoma State University.

6th Pacific Northwest Regional Quality Control Conference

On Friday and Saturday, Apr. 11-12, the 6th Pacific Northwest Regional Quality Control Conference will be held at the Benjamin Franklin Hotel, Seattle. This conference is jointly sponsored by the Seattle and Portland sections of ASQC.

The conference will have four concurrent sessions dealing with foods, aircraft and heavy industries, administrative applications, and general topics. Each session is planning on six papers or a total of 24 for the conference.

Further information is available by writing to Kenneth J. Lenaburg, chairman, 6th Pacific Northwest Regional Quality Control Conference, P. O. Box 61, Mount Vernon, Wash.

The second training session of the season was held by Dr. Fred M. Jacobsen, American Oil Co., on the subject of "Analysis of variance models."

SOUTHERN CONNECTICUT . . . The December meeting was held in Bridgeport. The speaker was A. E. Aubin, QC engineer for Royal Mc-Bee Corp., Hartford, who spoke on "The control of quality on complex assembly operations."

The section has been working on plans for an educational program which is to start after the first of the year. Ted Westerman, chairman of the education committee, hopes for good attendance at the basic and intermediate courses.

STATE UNIVERSITY OF IOWA . . . The December meeting was held at Sylvania Electric Products, Inc., Burlington. Attending members were able to see the various control techniques required to produce premium electronic tubes. The tubes primarily were of the miniature and sub-miniature size and required extremely high reliability. Consequently, their

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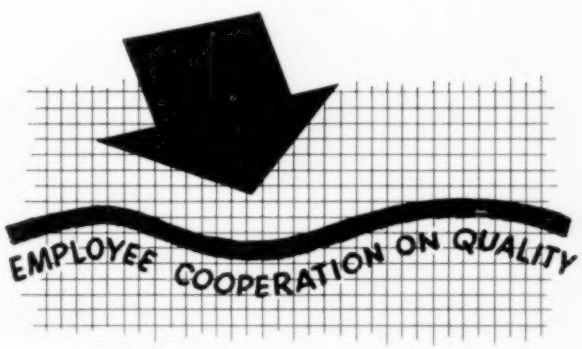

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quality control application throughout the plant, as well as their final acceptance and evaluating techniques, were of a very high caliber.

George V. Herrold of the Sylvania Electric Co., presented a paper on quality acceptance measures concerning electron tubes. The specific topic was comparing a method of acceptance based on "average defect level" rather than AQL level.

Robert Boeke of John Deere Ottumwa Works did an excellent job as an after-dinner speaker on the topic "Is your sampling showing."

Professor John A. Henry had as his topic "Acceptance sampling by variables." This again was a very enlightening and thought provoking presentation.

The next meeting is planned for Feb. 27-28, with headquarters at the Blackhawk Hotel, Davenport. A plant tour of the Red Jacket Mfg. Co. is planned. Prof. Gayle McElrath, University of Minnesota, is to present a technical session at this meeting.

TOLEDO . . . A most enjoyable time was had by all attending the Christmas party in the Great Lakes Room of the Toledo Club. Corsages for the ladies, refreshments, dinner, entertainment, and door prizes comprised the program. Mrs. Rosemary Carroll, Owens-Illinois Glass Co., was chairman and was assisted by Mrs. Beatrice Dorn, Doehler-Jarvis, Mrs. Alice Dooley, Owens-Illinois, and Margaret Tobin, General Tire and Rubber Co.

A plant tour through the Chevrolet Passenger Transmission Plant has been arranged by David A. Hettel for Thursday, Mar. 6.

A joint meeting with member societies of the Toledo Technical Council is scheduled for Thursday, Mar. 27 at Macomber High School Auditorium at 8 pm. Willy Ley, rocket and space travel expert from New York, will discuss "The conquest of near space."

TORONTO . . . The section enjoyed a very educational lecture by Fred G. Thompson, P. Eng. Salada Shirrif-Horsey Corp., on the subject of "An example of SQC and MTM co-operation" at the December meeting. Mr. Thompson kept the audience captive using fascinating props for his demonstrations. An extensive question and answer period concluded this informative evening.

The fifth annual all-day quality control forum sponsored by the section will be held on Mar. 8 at Hart House, University of Toronto. Registration fee is $7.50 and covers all sessions and the banquet. The program consists of 16 sessions on a great variety of subjects including a basic course in SQC, receiving inspection, packaging, metals, process control, operations research, aircraft, testing, textiles, small industries, chemicals, food, and electronics. The banquet will be held in the Great Hall. The guest speaker is R. W. Todgham, president of Chrysler Corp. of Canada, Ltd.

On Mar. 19 a joint dinner meeting will be held at the Sign of the Steer. Participants are: Guild of Accountants, Internal Auditors Institute, Methods Time Measurement Association, Operations Research Society of Toronto, and the Systems and Procedures Association. Dr. Solomon Barkin, director of research, Textile Workers Union of America, will speak on "Automation and industry's obligation to man."

WINNEBAGO . . . Fred R. Sheldon, research lab manager, Beero Chemical Div., Food Machinery and Chemical Corp., was the main speaker at the December meeting. His subject was "Taking the guesswork out of research and development statistics." Fifty-eight members and guests were present. A training session preceded the regular meeting.

The Mar. 10 meeting will be held at the Elk's Club, Appleton. Final plans for the one-day clinic to be held Apr. 14 at Green Bay will be discussed.

WORCESTER . . . A. C. Rosander, chief of the sampling and estimating methods section of the Internal Revenue Service, presented an excellent talk on the subject "The control of quality and cost." It stimulated interest from accounting and clerical supervisors in the area as well as quality people.

YOUNGSTOWN . . . On Dec. 5 William W. Wolman, statistical consultant, Bureau of Yards and Docks, Department of the Navy, was the guest speaker. He gave a talk on the "New military standards for inspection by variables."

On Mar. 6 Dr. Leonard Arnoff and staff of the Case Institute of Technology will present "A case study on operations research."

SIGNIFICANT DIFFERENCES

. . . Binghamton—Herman G. Salisbury, by-laws and constitution chairman and chief inspector of the Raymond Corp., has been promoted to manager of quality control.

C. H. Rubin, section chairman, is recuperating from a very recent operation.

Martin Schatzoff has been promoted to the position of manager, reliability analysis and prediction, of the IBM Product Development Laboratory in Endicott. Martin's new title is project satistician.

. . . Cincinnati—Larry Girton, section treasurer, has been transferred to Proctor and Gamble's Lexington, Ky. office. Mrs. Ada Diehl has been elected to fill his section office.

Dorian Shainin, Edwin Harrington, Warren Purcell, Leonard Seder, and Herbert Jacobs, will instruct at the Fourth Annual Advanced Statistical Quality Control Institute to be held at the University of Connecticut, March 23 thru April 4, 1958. For brochure, contact R. M. Story, Jr., Box U-41, University of Connecticut, Storrs, Connecticut.

RESEARCH INFORMATION

The Research Information Committee of the American Institute of Industrial Engineers is starting to secure abstracts of research performed in the period July 1, 1952 to July 1, 1957. The information collecting program will provide a valuable service to industry and universities and especially to industrial engineers. Research abstracts are to be collected in the areas of:

Work Measurement	Organization Planning
Methods	Industrial Statistics
Plant Engineering	Production Control
Human Engineering	Data Processing
Engineering Economics	Operations Research

Cost Analysis

The Committee will appreciate all information on industrial engineering research, past and present, about which it might gather more specific details. Please write to:

Research Information Committee, AIIE
Department of Industrial Engineering
Washington University
St. Louis 5, Mo.

Dick Hausman of the Ford Motor Company's local transmission plant, has been transferred to Ford's new automatic transmission plant at Sharonville, Ohio as supervisor of QC.

Paul Robert, past Society president, is now general manager of Precision Products Division, K-D-I Corp., Norwood, Ohio.

. . . Cleveland—In the December issue of "Industrial Quality Control" we reported Howard Streich as being promoted to quality control **co-ordinator** of The Swartwout Company. His correct title is quality control **manager.**

. . . Corning-Elmira—Jay E. Roseeky has joined the quality control staff of the Technical Products Division, Corning Glass Works.

. . . Cumberland—David A. Powers has assumed the position of quality control superintendent at the Ameelle Plant of Celanese Corporation of America. Mr. Powers previously headed the QC department of Celanese Corporation's Celco Plant at Narrows, Va.

. . . Dallas-Fort Worth—Dr. A. W. Wortham, chairman of the section and director of operations research, Semiconductor-Components Div., Texas Instruments, Inc., has been elected representative to the council of the American Statistical Association for District 9 for 1958-59.

. . . Dayton—Ben S. Graham has been chosen to head the newly formed Systems and Procedures Division of The Standard Register Company.

. . . Harrisburg—Willard Smith of Amp, Inc., has been appointed administrator of the Machinery & Customer Tooling Department, Automatic Machine Division. Succeeding him as QC manager is Richard Smeloff.

. . . Metropolitan—On Jan. 31 Harold F. Dodge, Quality Results Engineer, retired from Bell Telephone Labs, Inc.

. . . Philadelphia—David Kohlhas of Lukens Steel Co. has been promoted from the quality control department to assistant to the manager of production control.

. . . St. Louis—Edward Schmalenberger has changed positions from White-Rogers to Universal Match Co., Pittsburgh, Pa.

Andrew Taylor of Keasbey-Mattison has been promoted from quality control engineer to factory manager.

Clifford A. Statler, formerly with McDonnel Aircraft is now quality control engineer at Keasbey-Mattison.

. . . South Bend-Mishawaka—Arnold Johnson has been promoted from quality manager to quality administrator of the Aircraft Division of the Bendix Aircraft Products Corp., South Bend.

F. E. Bremer, Jr. has been promoted from assistant quality manager to quality manager of the Aircraft Division of the Bendix Products Corp., South Bend.

. . . Syracuse—Albert L. Edgar has been appointed director of programming and systems study in the financial division of Bristol Laboratories.

. . . Toledo—Jack B. Schneider, Toledo Stamping and Manufacturing Co., is general chairman of the Engineers' Week Banquet to be held Feb. 20 at the Hotel Commodore. Other section members who will assist Mr. Schneider are: David A. Hettel, Johnson-Ruth Machinery Co.; William W. Pound, Wm. W. Pound Machine and Tool Co.; and Ray E. Crouse, Dura Div. of Detroit Harvester Co. Anticipated attendance is expected to be 1000 engineers.

. . . Toronto—The chairman of the section, Mike J. O'Callaghan, has been appointed lecturer of statistics and quality control for the Industrial Organization and Planning Course, University of Toronto. This course is sponsored by the Canadian Industrial Management Association.

clinics, conferences, and courses

FEBRUARY

. . . ***28-Mar. 1—Middle Atlantic Conference, Hotel Statler, New York City, sponsored by ASQC, contact F. W. Kroll, Jr., Program Chairman, Esso Standard Oil Co., Box 222, Linden, N. J.***

. . . **26-28**—Box Method of Experimentation, Charleston, W. Va., contact Ben H. Carpenter, Carbide & Carbon Chemicals Co., Development Dept., South Charleston 3, W. Va.

MARCH

. . . **3-6**—International Conference and Exhibit, Shoreham Hotel, Washington, D. C., sponsored by the Gas Turbine Division of ASME, contact Barry Freer, 1300 Connecticut Avenue, N.W., Washington 6, D. C.

. . . **10-20**—Quality Control Short Course, University of Illinois, Division of Engineering Extension, Urbana, Ill., contact Professor John A. Henry, Room 205, Mechanical Engineering Laboratory, University of Illinois, Urbana, Ill.

. . . **11-19**—Basic Quality Control Short Course, sponsored by Georgia Institute of Technology and the University of Georgia, to be held in new Continuing Education Building, Athens, Ga., contact A. C. Cohen, Jr., Mathematics Departments, University of Georgia, Athens, Ga.

. . . ***15—First National Conference, Rackham Bldg., University of Michigan, Ann Arbor, sponsored by Automotive Division, ASQC, contact Theodore W. Miller, QC Engineer, Detroit Transmission Div., GMC, Ypsilanti, Mich.***

. . . **15**—Midwest Conference, "Statistical Techniques and Analysis Used in Planning Metropolitan Area Expansion," Congress Hotel, Chicago, sponsored by Chicago Chapter of ASA, contact Lawrence R. Stickler, R. R. Donnelley and Sons Co., Chicago, Ill.

ASQC Personnel Listing Service

A new service has been inaugurated for ASQC members only. Any member desiring to be listed as available for new employment opportunities should send a brief resume (on 3 × 5 file card, or cards) to ASQC Personnel Listing Service, Room 6197 Plankinton Building, 161 West Wisconsin Avenue, Milwaukee 3, Wisconsin.

All information will be kept confidential and those listed will be sent descriptions of all suitable opportunities for 60 days following receipt of this initial listing. If it is your desire to remain on the list after this period, you can do so by writing in to the same address and requesting an additional 60 day period. If you do *not* request an extension, your resume will be removed from the file on the assumption that you have made a successful connection.

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. . . 20-21—Cost Control Through Engineering, North Carolina State College, Raleigh, N. C., sponsored by the Textile Engineering Division of ASME, contact E. Lee Harrisberger, Department of Mechanical Engineering, North Carolina State College, Raleigh, N. C.

. . . 23-Apr. 4—*Fourth Annual Advanced Statistical Quality Control Institute, University of Connecticut, Storrs, Conn., sponsored by New England sections, ASQC, contact R. M. Story, Jr., Box U41, University of Connecticut, Storrs, Conn.*

APRIL

. . . 11-12—*6th Pacific Northwest Regional Quality Control Conference, Benjamin Franklin Hotel, Seattle, co-sponsored by Seattle and Portland sections, ASQC, contact Kenneth J. Lenaburg, Conference Chairman, P. O. Box 61, Mount Vernon, Wash.*

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